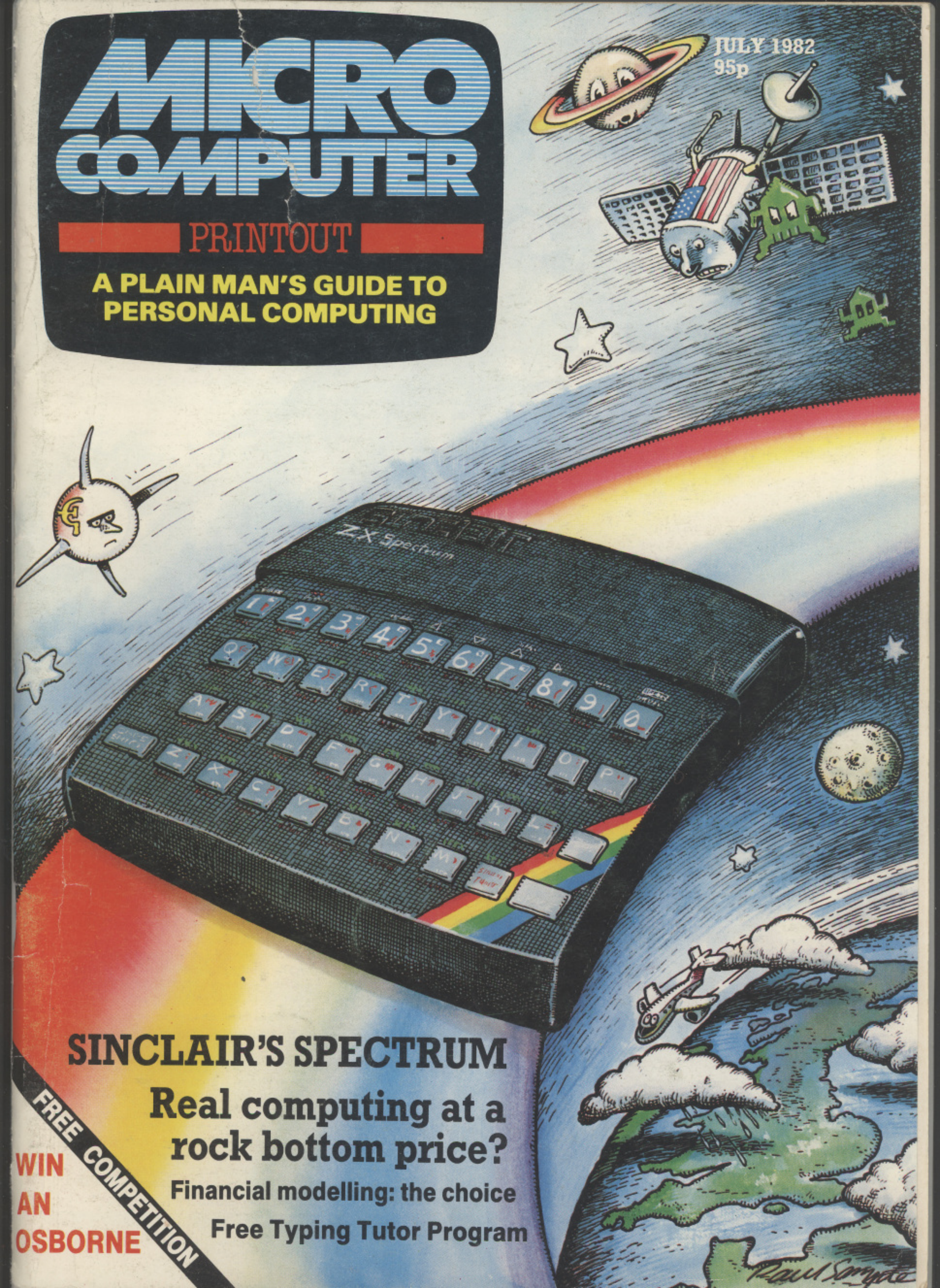
MICRO COMPUTER PRINTOUT

A PLAIN MAN'S GUIDE TO PERSONAL COMPUTING

JULY 1982
95p



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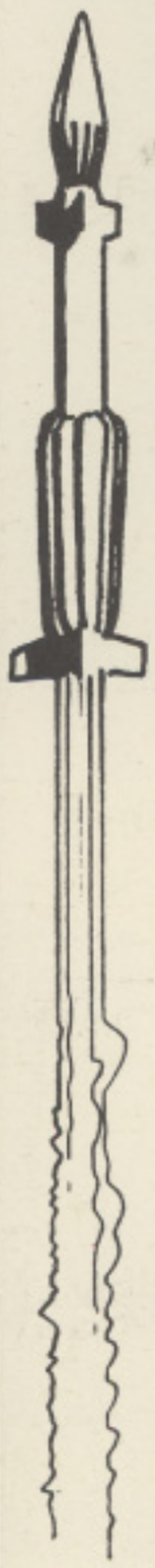

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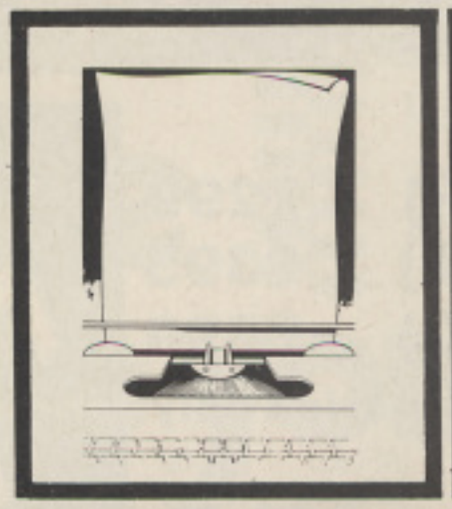

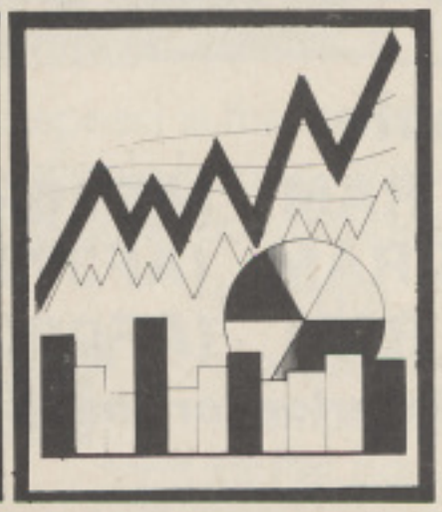

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Writs Inward: c/o Banco Reliabilo, Plaza Gringos, Buenos Aires
Editorial Address: P.O. Box 2
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Advertisement Executive: Karen Chambers
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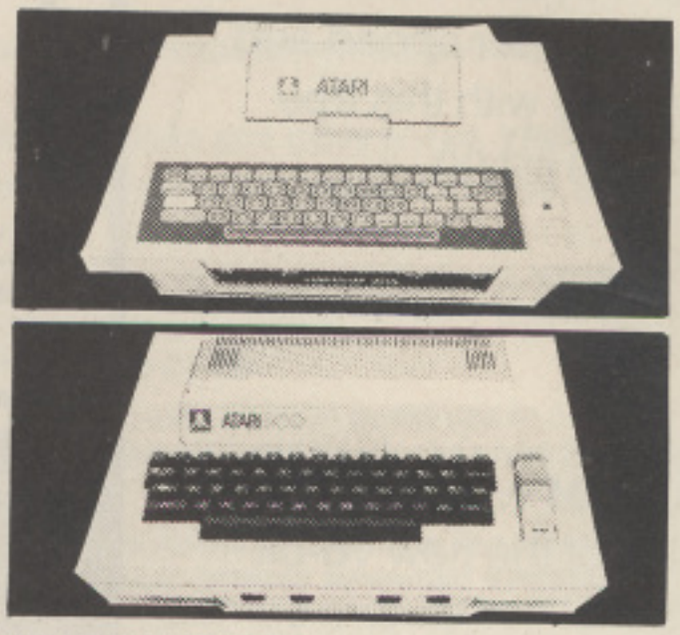

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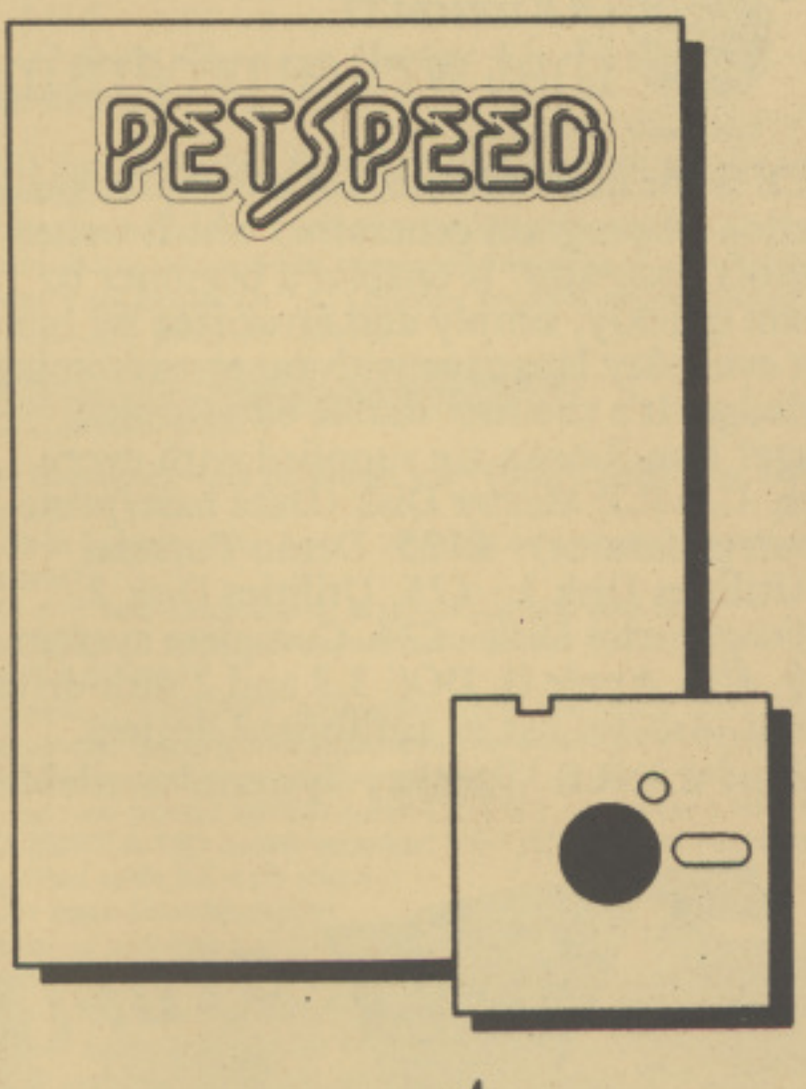

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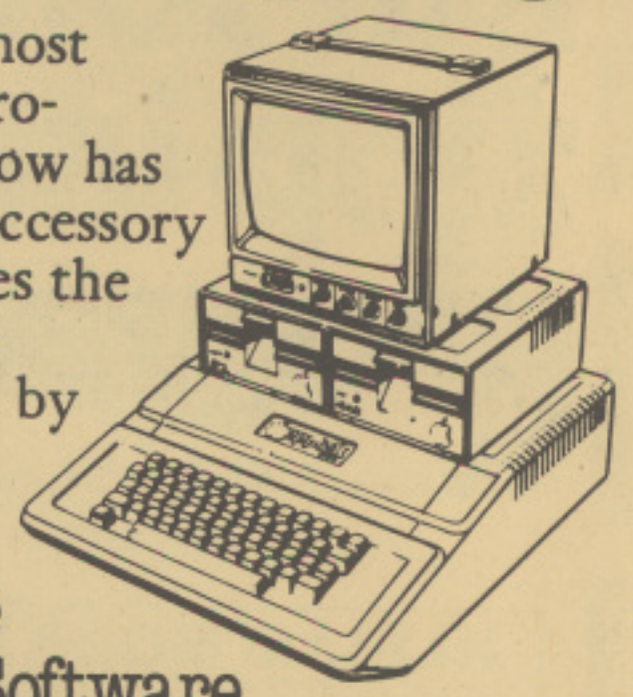

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C.O.R.P. is the most advanced and comprehensive collection of program generators which writes Applesoft programs. It enables a beginner to program quickly, simply and error-free by himself in everyday language with no programming knowledge. It's the first usable educational package! Handbooks are supplied with every system. C.O.R.P. Master Disk (Data base/print program generator) - £125. Demo Tutorial - £25. Utilities Disk 1 - £75. Utilities Disk 2 - £29. Diagnostics Disk - £24. Complete system - £269. 48K Apple II, DOS 3.3 and 2 disk drives required. Ask for list of authorised dealers. Details of C.O.R.P. 'Turnkey Systems' available.

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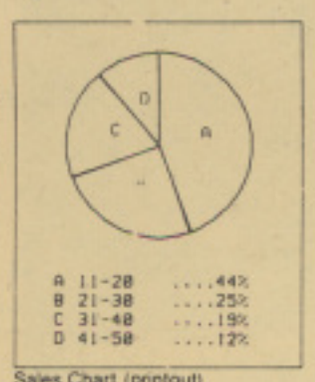
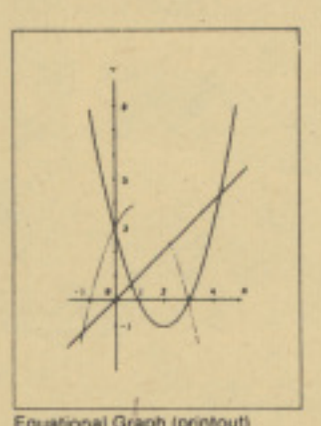
Four Colour high resolution (500 x 200) printer/plotter with **9 type sizes** and **4 print directions** (CE-150)



Sales Chart (printout)


Equational Graph (printout)

TWO cassette control for bulk data & program storage with remote control (CE-150)
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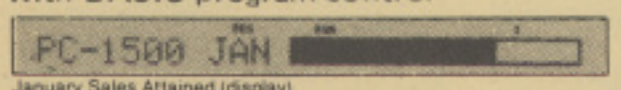
Up to **thirty-six separate programs** immediately accessible
Twenty-six character LCD display doubles as **1092 point mini-graphic display** with BASIC program control



January Sales Attained (display)

256 frequency tone generator with BASIC repetition, frequency and duration control
Built-in month, date, hours, minutes and seconds **clock,** usable in BASIC programs
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	CE-150 Four Colour Printer + £20 voucher	£159.95	
	CE-151 4K Byte RAM Module + £10 voucher	£ 49.95	
	CE-155 8K Byte RAM Module + £10 voucher	£ 79.95	
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A Beginners Guide

"Don't plug Commodore" said the man from Commodore. "Write us an essay that people will find useful instead." It was an offer I couldn't refuse.

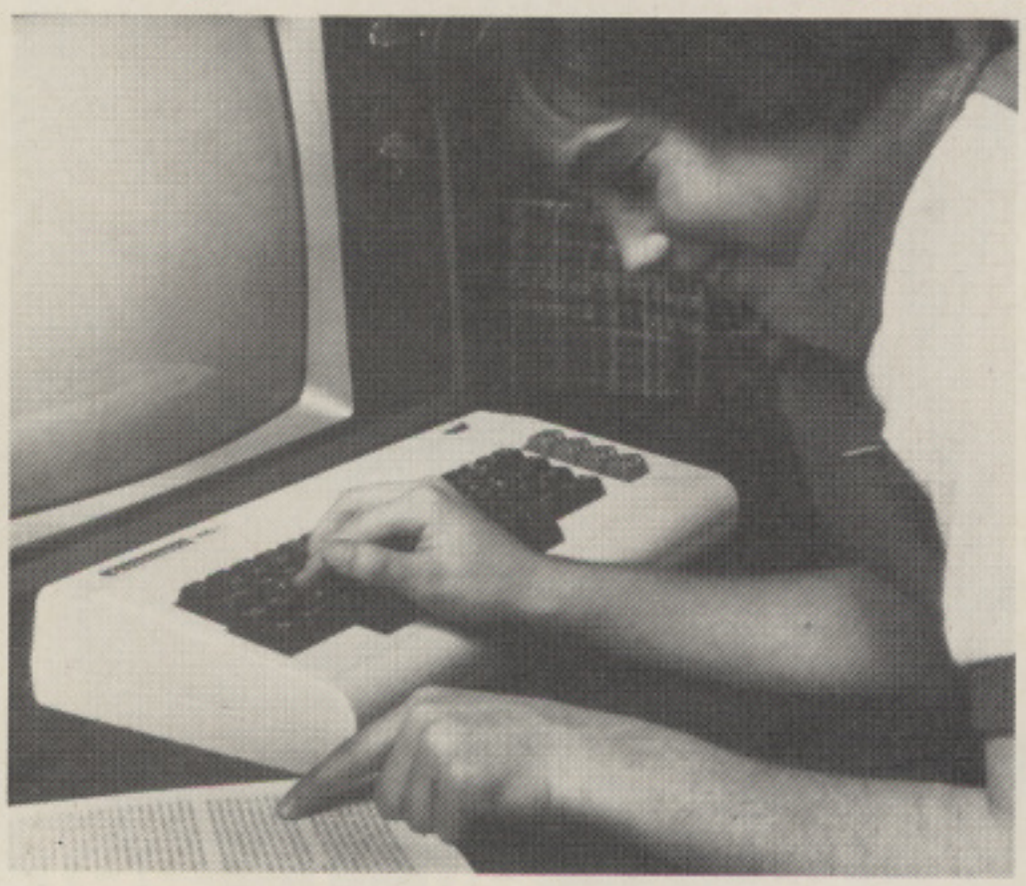
First things first then. Money. What do the darn things cost?

At Home

Anywhere between £70 and £7000. Maybe more. What you need spend is, of course, another matter. To a large extent you get what you pay for. But for a real computer that you can use at home the VIC-20 at £189 including VAT has to be a strong candidate. Why?

Colour graphics (assuming you have a colour TV) and a proper typewriter keyboard for a start. And sound. And plug-in program cartridges.

Budget another £45 for a cassette recorder to store your own programs; typing them in from scratch everytime is a real pain. It is likely you will want to add some additional memory to the 5K of Random Access Memory (equivalent to about 5000 characters of text) the VIC-20 arrives with. That's because only 3K is actually available for programming. Plugging in an extra 8K RAM cartridge will make a £45 hole in your pocket – but it will allow you to play Space Invaders!



Other popular and currently available home micros to consider are the ZX80 at £73, and the Atari 400 at £345.

In the classroom

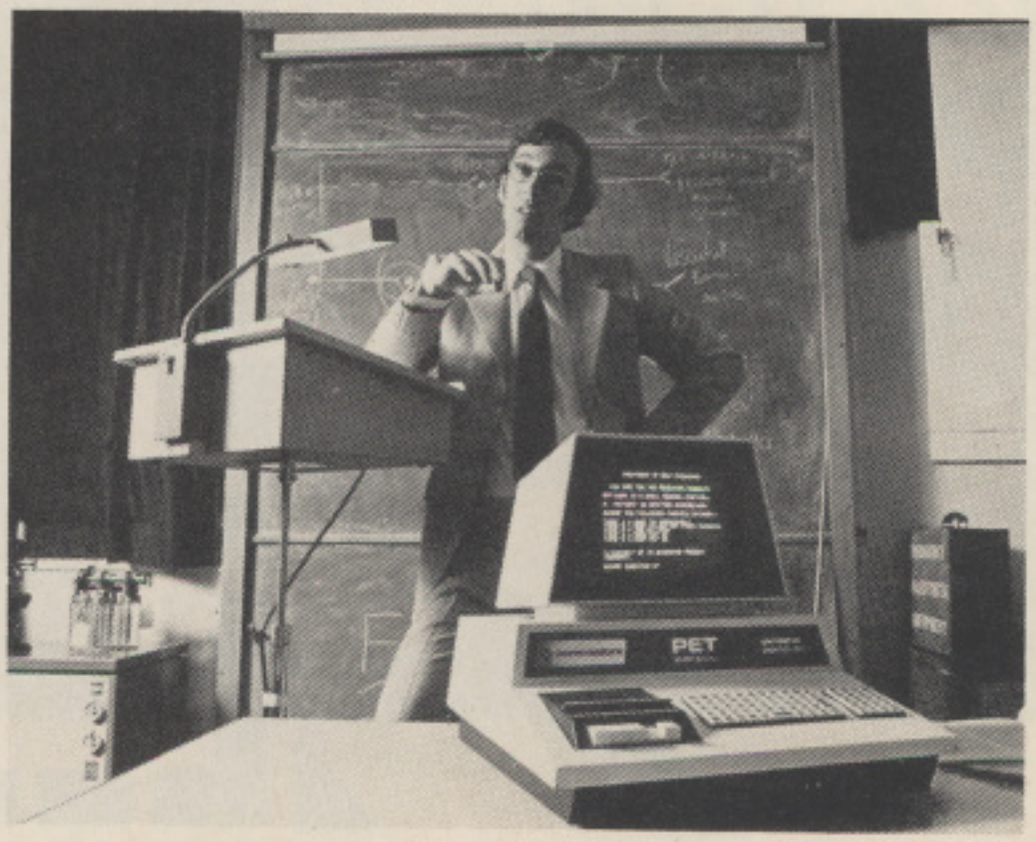
Schools have tended to opt for machines like the PET, the most popular choice, at £550 + VAT for 16K version, or the more expensive Research Machines RS380Z. For this you get a built-in black and white screen, for giving upper and lower case letters plus graphics. As with all Commodore machines, the BASIC language – very easy to learn – is built in.

The other major plus is the software. Lots of it available from independent suppliers. Commodore even give it away free if you are a school. Or you can swap with other teachers.

In business

Advising businessmen on the right micro is tricky; so much depends on the quality of the programs. In fact some experts recommend looking for the program first. Fortunately for Commodore I can put hand on heart and say that no system offers a wider range of off-the-shelf business programs than the PET.

There are a few businessmen that get by with 16K of RAM memory and a cassette drive – but not many. A more sensible configuration would be 32K of memory and a floppy disk unit. Quite a few companies offer this specification including Apple and some of the new Japanese machines.



to Micro Computers

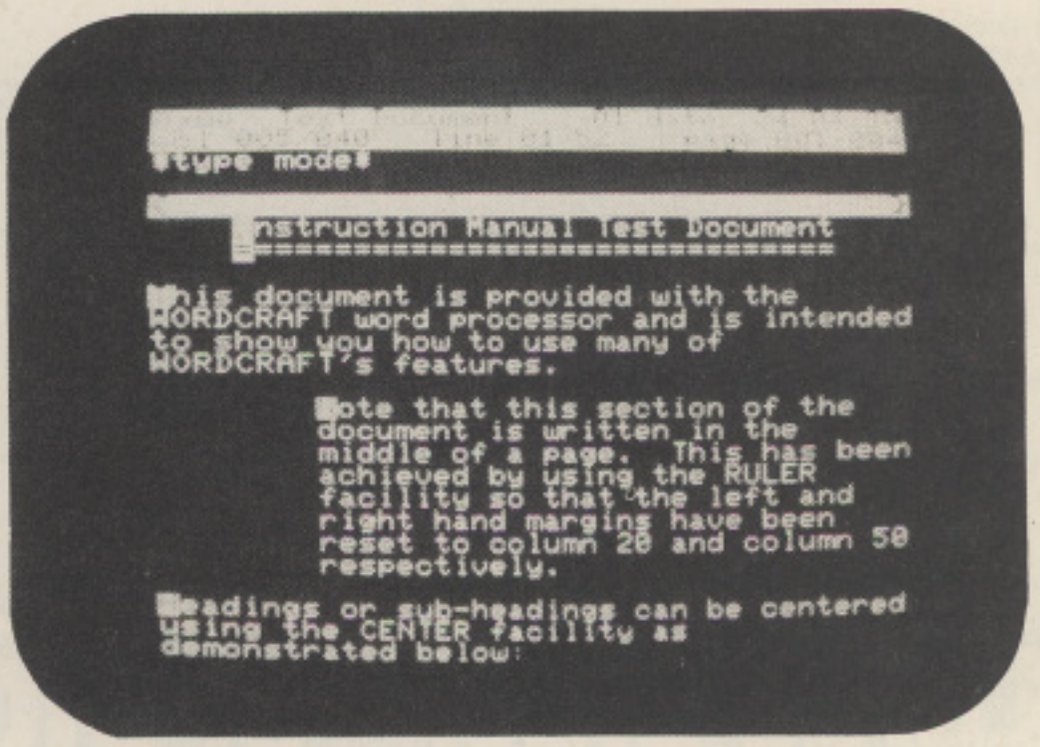
by C.R. Oppenheim

To give you an example of pricing, the 32K PET with 337K bytes (characters) floppy disks costs £1390 + VAT. The Apple price would be similar but with much lower capacity disks. Add £395 ex VAT for a dot matrix printer and you have a pretty effective business system for around £1800.

A good sales/purchase ledger package will cost around the £300 mark on the most popular microcomputers, perhaps twice this price on the others. Economies of scale you see.

Word Processing

Word Processing is probably the single most popular business application; it is so useful for sending personalised letters and maintaining lists.



After looking at more expensive systems I chose a SuperPET; its larger screen giving me lines of up to eighty characters long. Keyboard layout is QWERTY like a typewriter, so my secretary's happy too.

After the American *WordStar*, which runs on CP/M based machines, *Wordcraft* is probably the best known word processing program, and at £375 + VAT it has the merit of being cheaper. After careful consideration that is what I chose.

Whilst dot matrix printers, which as the name suggests create the letters out of dots, are fine for accounts, a typewriter quality printer is better for word processing. Commodore's new daisywheel at £850 + VAT looks like a bit of a bargain; if you are feeling rich you could pay £2000 for another make which would get through your letters even quicker.

Adding up the cost of a Word Processing system based on the 32K SuperPET with the powerful 1 megabyte disks (they store 1 million characters approximately, the length of a Dickens novel!), the price comes in around £3000 + VAT. That's including the software!

That's about all I have space for, for now. But if you have any queries, drop me a line c/o Commodore. Or alternatively fill in the coupon for further details and the name of your nearest dealer.

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675 Ajax Avenue, Slough, Berks.
Tel: Slough 79292

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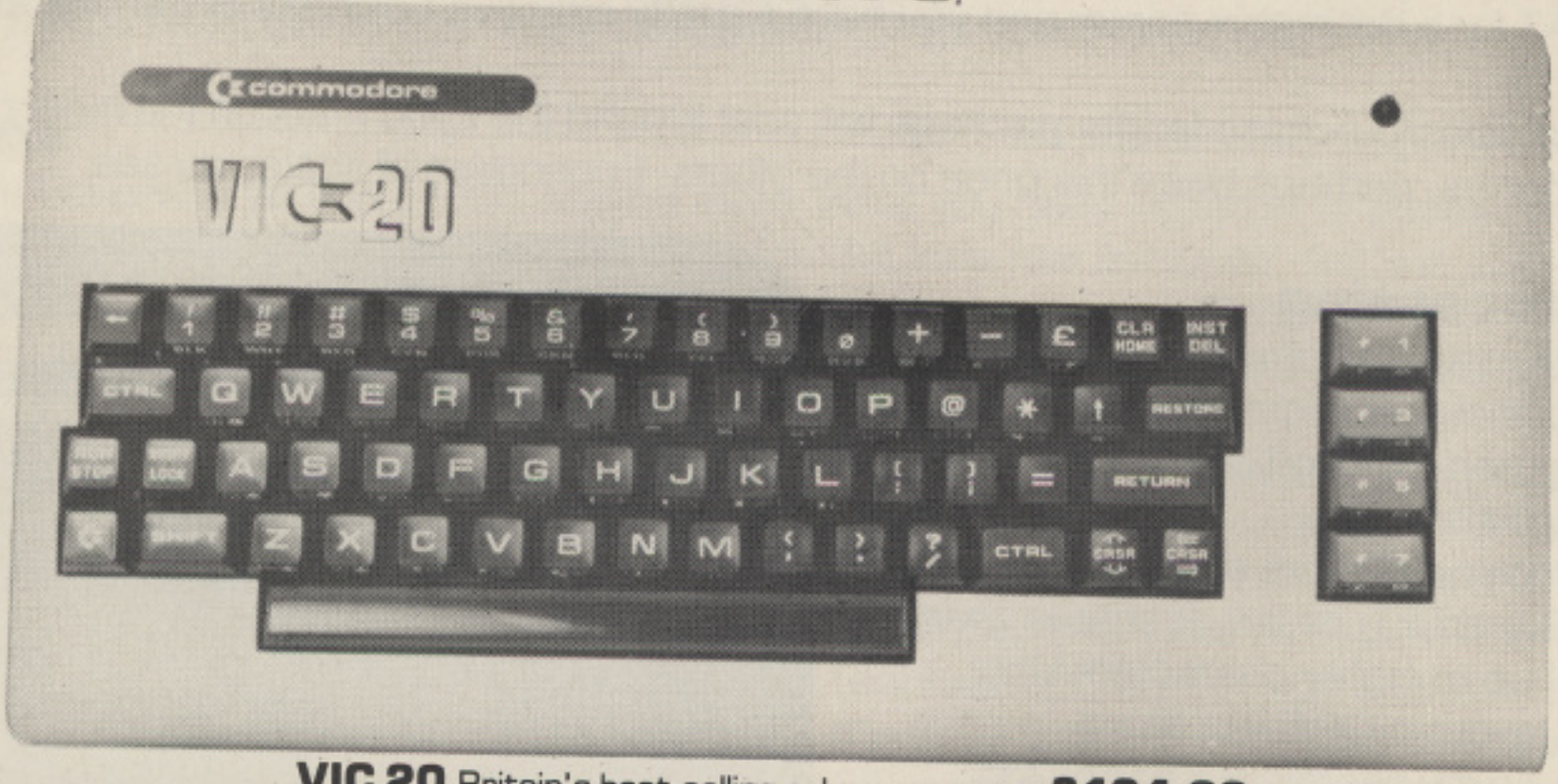

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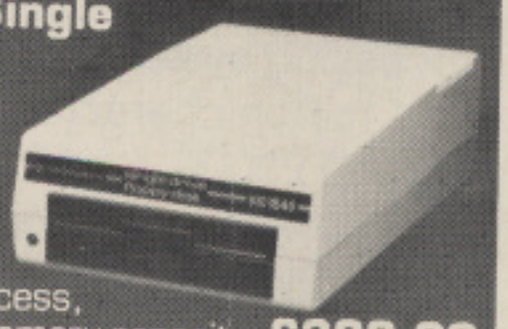

Fast access, large memory capacity. **£389.00**

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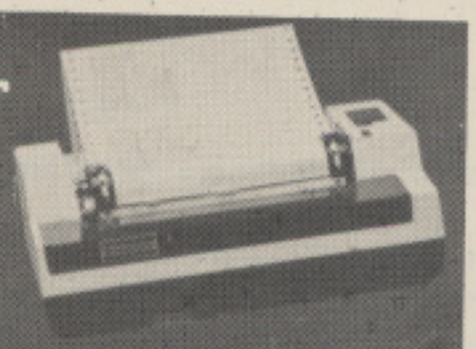

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CP/M® for the PET .....

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Simply by plugging the SMALL SYSTEMS SOFT BOX into the PET IEEE port and loading the CP/M disk, the PET will run under the world's most popular disk operating system, CP/M (tm). No internal connections or modifications to the PET are required.

Application packages designed to work with specific terminals (e.g. Lear Seigler ADM3A, Televideo 912 or Hazeltine 1500) will need no modifications to work with the PET screen, as the SMALL SYSTEMS SOFT BOX allows the PET screen to emulate any of these devices.

Specifications

- Full 60k byte RAM
- CP/M version 2.2
- Z80 CPU running at 4MHz with no wait states
- Dimensions: 25cm x 9cm x 16cm
- Operates with any series 2000, 3000, 4000, or 8000 PET
- Supports up to 8 Commodore disk drives in any mix of 3040, 4040, or 8050 drive types.
- Diskette containing CP/M system with utilities, and full documentation included in price. Please specify 3040, 4040 or 8050 disk format when ordering.
- Optional RS232 serial interface (with user definable baud rates) for use with a terminal or printer.
- Optional Corvus hard diskdrive interface.

SoftBox prices

SoftBox £550
SoftBox with RS232 interface £595
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5MB Corvus drive £2295
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20MB £4495
Mirror back up unit £495
Constellation £495

Stand alone capability

The SoftBox, in conjunction with a standard VDU, will operate as a stand alone CP/M system with built in IEEE-488 interface operating with ·5 MByte floppy storage or upto 80 MBytes of hard disk storage.

CP/M Software

LANGUAGES

ALGOL-60 (Research Machines) £130/£20
ALGOL is a powerful block structured language featuring economical run-time dynamic allocation of memory. The compiler is very compact (24k) and supports almost all Algol 60 report features.

C COMPILER (BD Software) £80/£15
This compiler supports most major features of the language including structure, arrays, pointers and recursive function evaluation. The compiler produces compact, relocatable 8080 code for use with the linker and library supplied.

CBASIC Compiler Systems £75/£12
This is a non-interactive BASIC used by many business application programs, It supports full file control chaining formatted output and random disk file access, 14-digit arithmetic WHILE/-WEND and optional line numbering.

C COMPILER (Whitesmith's) £455/£25
This compiler conforms to the full UNIX version 7 implementation of the C language, which has more facilities than Pascal or BASIC and produces faster code.

S-BASIC £195/£20
A structured BASIC compiler generating 8080 native code, combining structured programming and the speed of machine code while maintaining the convenience of BASIC.

BASIC-80 (Microsoft) £175/NA
This is Microsoft Extended BASIC interpreter, version 5. It is a powerful, ANSI compatible disk BASIC with many features not found in PET BASIC, such as WHILE/WEND, chaining, variable length file records, double precision floating point, PRINT USING facility, error trapping, hexadecimal numbers and more.

BASIC COMPILER (Microsoft) £205/NA
This compiler is language compatible with the Microsoft version 5 interpreter but generates 8080/Z80 machine code, so that program execution is typically 3 to 10 times faster.

COBOL-80 (Microsoft) £375/£20
An ANSI '74 COBOL compiler producing relocatable modules compatible with FORTRAN-80 or MACRO-80 output. COBOL-80 has a complete ISAM facility and interactive screen handling.

CIS-COBOL (Microfocus) £425/£30
An ANSI '74 standard COBOL compiler fully validated by U.S. Navy tests to ANSI level 1. The compiler also supports many features of level 2 including dynamic loading of COBOL modules and a full indexed Sequential (ISAM) file.

FORTRAN-80 (Microsoft) £230/£20
The popular science and engineering language, complying with the ANSI '66 standard (except for the Complex data type), with enhancements such as mixed mode arithmetic.

PASCAL/MT+ £375/£20
A Pascal compiler meeting the ISO standard, with many enhancements including full string handling capability and random access files.

PASCAL/M £220/£15
This compiler produces p-code and is an extended implementation of standard Pascal, with long (32-bit) integers, a SEGMENT procedure type (for overlays) and an added string data type.

PASCAL/MT £160/£20
This is a subset of standard Pascal, which generates ROMable 8080 machine code and supports interrupt procedures, CP/M file input/output, and assembly language subroutines.

PASCAL/Z (Ithaca Intersystems) £225/£20
A compiler producing ROMable, re-entrants Z80 micro-code highly optimised for speed, supporting variant records strings CP/M file input/output, and assembly language subroutines.

PRO PASCAL £190/NA
This Pascal Compiler implements the full proposed standard with improvement extensions such as random access files, strings and program segmentation. Pro Pascal is designed specifically for the Z80 and produces relocatable machine code which is very fast and compact. A linker and cross-reference generator are provided, and Pro Pascal object code may be used in READ only memory.

muLISP £110/£15
LISP is an interactive programming language widely used for artificial intelligence applications.

PL/I-80 (Digital Research) £325/NA
A general purpose application programming language giving mainframe capability for developing large-scale structured programs in a microcomputer environment.

TINY C TWO £130/£30
A compiler written in TINY C. The source code is included on disk.

WORD PROCESSING

WORDSTAR (MicroPro) £255/£35
A powerful screen-oriented word processor designed for non-technical personnel. Text formatting is performed on the screen; so that what you see is what your print-out will look like. WORDSTAR'S advanced facilities include justification, pagination, underscores, boldface, subscript and superscript, block movement of text.

WORDINDEX (MIDAS) £150/NA
A program to assist WORDSTAR users by generating a table of contents and index from a WORDSTAR document.

MAILMERGE (MicroPro) £80/£15
MAILMERGE is an add-on utility for WORDSTAR users allowing the production of personalized form letters or other documents from a mailing list made using DATASTAR or NAD. Requires WORDSTAR.

MICROSPELL £165/NA
This is a spelling help program which scans through a document file stopping at each dubious word, offering correctly spelt alternatives and allowing you to correct the word with a keystroke.

TELECOMMUNICATIONS

BSTAM £115/NA
This telecommunications utility permits any type of CP/M file to be transferred to or from another computer also equipped with BSTAM. Transmission occurs at full speed with CRC error checking and automatic error recovery.

BSTMS £115/NA
An intelligent terminal program permitting communication with a mainframe computer.

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An advanced utility for preparing management reports with tabular data, combining visual calculator with a full screen editor.

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The number one Financial Modelling and forecasting program.

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A customised data entry and reporting system in which the user specifies up to 75 data items per record, and can use interactive data entry, retrieval and update facilities to make information management easy.

muSIMP/muMATH £140/NA
A package of programs including muSIMP, a high level programming language for symbolic and semi-numeric processing, and muMATH, an interactive symbolic mathematics system written in muSIMP.

STATPAK £260/£20
A professional statistics and probability package which can rapidly handle large files of data.

DATA MANAGEMENT SYSTEMS

dBASE II £385.00
An interactive relational database management package with full screen formatting and its own fully structured high level command language. Interactive data entry and Validation with WordStar-like commands. Allows you to develop application packages in days rather than months.

MDBS £675/£30
Micro Data Base System is a full network data base with all the features of HDBS, with fixed or variable record length, read/write protection at the ITEM, RECORD, SET and FILE levels.

LANGUAGE APPLICATION TOOLS

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HOW TO BUY A PAY

Spencer Hall concludes his series on Buying a Business System – with a look at Payroll, and gives answers to a few common queries.

This month we shall conclude the current series which has been looking at the effects of computerising the main books of account in a typical small business. We have covered all the main 'departments' of a normal business set up with the exception of Payroll, which is the main topic of this month's investigation.

Payroll is most people's *raison d'etre* of life – you work to earn money to pay the bills. From the employer's point of view it is a pain in the neck in that not only do you have to pay your employees, you also have to pay people to pay people. So a program which can help reduce unwanted overheads must be a good thing? Yes, my dear Watson – assuming of course that the program itself is a good thing.

So should you bother to buy a payroll program for your micro? The first question you should ask is how many people do you pay on a regular basis? If you only have 10 or so employees most of whom are on a standard weekly wage without complicated bonus schemes or overtime then don't waste your money.

If on the other hand you have more than 25 or so employees who are all entitled to overtime at various rates, bonuses, commission payments and other complications such as awards of court, company cars, union dues and private pension agreements then do not pass Go, do not collect £200 but go straight to your computer shop clutching your Access card.

As a rough rule of thumb, don't bother with a payroll program unless you spend at least one hour a week (or month) preparing your payroll. If you spend more than that then you are probably big enough to justify computerising other areas of your business if you haven't already done so.

So even if the machine was only used for one morning a week, it would still be cheaper to use their own desk top micro than a bureau, or process the payroll manually. Of course, they won't actually do that because their computer advisor (the DP manager) has a vested interest in processing as much data as possible on his expensive mainframe in order to recover his fixed overheads, and the Board aren't smart enough to see it. Oh to be part of British Industry now the micro chip has arrived!

So having decided that your life is incomplete without a payroll program, your next objective is to identify which one best meets your requirements. If you have a CBM PET then don't go looking at CP/M packages because they won't run on your computer (unless you spent £500 on a Stunt Box which jacks up the costs quite considerably). There will probably be around half a dozen possibles which quickly shake down to a couple of serious contenders which meet your requirements.

Luckily payroll programs are quite cheap so even if you do drop a clanger you won't have wasted more than about £250 on your learning curve. The program should come with a reasonable standard of documentation – if it doesn't then the program isn't finished. Put it back on the shelf.

Next, sit down and try operating it without looking at the manual. This could prove tricky on a program which isn't well sign posted. If you do get stuck, how well does the manual relate to the program – if you cannot find the section in the manual which relates to your problem within 60 seconds, then you may be looking at the wrong manual, or it was written by someone who has not seen the program. Put it back on the shelf.

approach and renders the programmer liable to instant nomination for the 'Maximum Inconvenience Factor' Award. I have seen payroll programs which neither programmers nor qualified accountants have been able to understand. This added inconvenience was provided at no additional charge once your cheque for £150 had cleared the banking system.

Does the program enable you to make your own modifications for changes in rates of Income Tax? Since these normally change at least once a year (although it was fashionable to change them more frequently) it is obviously better if you can modify the tables yourself, than to have to pay the software house for the privilege. They will almost certainly charge you for the honour. Therefore you should be able to change not only the rates but also the bands at which tax has to be deducted.

Does the program cope with the more unusual codes such as British expatriates working overseas who do not have tax deducted at source but do have to pay National Insurance. Also those who have a 25% reduction because they work some of their time overseas. If all your employees work in the UK then this won't really affect you but it does give some indication of the facilities offered by the program.

How many rates of standard pay can the program accommodate? In a trucking company there may be mileage allowances, time away from home allowances, bonus payments, shift allowances, overtime at different rates etc. These all have to be shown separately on the pay slip – make sure that the program can cope with this sort of analysis.

Look at the types of deductions which can be made. Some deductions such as pension are offset against gross pay while most others are against net pay. How many deductions are you allowed? What about maintenance payments to County Courts? Union dues? Social Club? Christmas Club? Savings Club? Can you make the deduction based on a percentage of the gross before overtime? Some of these more obscure requirements may not be offered on the more basic types of package. Don't go overboard because I've mentioned them – just make sure that the program meets your foresee-

Vested interest

Many large companies with 150 or more employees on the weekly payroll could probably justify buying their own small microcomputer for doing just payroll and nothing else.

Inconvenience factor

Can you understand the terms used by the program? Most programmers invent their own jargon to describe the process of paying someone. This is an outstandingly unhelpful

.YROLL

able requirements.

Company cars

How well does the program cope with company cars? At last the individuals who benefit from their private use are being taxed accordingly. However, the rates vary according to the size of the engine, the annual mileage covered and the age of the car. How well does the program stack up to that little lot?

The quality of printed output should be in a form which enables your employees to work out how much they've been paid. Therefore all boxes should be clearly labelled and their function easily identifiable. The program must also produce P35's and P60's at the end of the year for all employees, and the P45 for those employees who leave during the year.

What sort of department analysis does the program offer at the end of the run? A good payroll should provide a breakdown of the payroll costs of each department within a factory for monthly management accounts. Obviously coinage analysis must be provided. A summary detailing the total gross, pension deductions, overtime, bonuses, commission payments, National Insurance (both employers and employees), list of leavers and joiners, Union Subs. etc. should also be provided as a matter of course.

Another useful feature is the ability to recall all of the entries on an employee's card for the year to date. OK, so you could get at the figure for total of an employee's County Court deductions by looking at all the pay slips for the entire year. But it's a hell of a lot easier if you can print out a summary of all transactions for that employee for the current tax year to date. You've not had to plough through 150 pay slips when there's one for each week of the year? Try it some bank holiday!

Some payroll systems offer the facility to interface to a timeclock so that a computer tape keeps track of who's working and who's not without operators having to key the information in. This can be very useful but employees may not trust a clock card they can't see – so complete integration may generate union problems. A half way house where the clock card used by the employee is read directly by the computer may offer a more sensible solution. The employee can read the card, and the computer simply reads the corresponding magnetic data. However, watch for manual override facilities when entertaining this level of automation.

Back-up

It is also helpful to make back up arrangements should your computer fail just as the processing run is supposed to start. Have you tried explaining to 100 impatient employees waiting for their pay packet that there has been a computer failure? Bid your farewell and trust that the Teleporter will work first time.

The only effective way to test out a program is to try out some live data on it to get an idea of the sort of contribution it can make to the smooth running of your office. Take your payroll clerk with you when looking at various possibilities – at the end of the day they will have to operate the program. Any reasonable computer dealer or software house will not object to a genuine customer who adopts this approach. If they do then simply vote with your feet and take your custom elsewhere.

Remember that computer fraud is rather easy on a payroll – you just forget to take leavers off the payroll so that the company continues to pay them. Only you collect their money. Remember the programmer who collected all the odd half pennies and dumped the total into the last name on the payroll. The idea worked a treat until the company took on an employee with 2 Z's and 3 X's in his name who could not understand why his bonus payments were so big!

So look for some of the above points when evaluating a payroll program. If the program doesn't feel right then put it back on the shelf – there are usually plenty of payroll programs to choose from.

* * * * *

A number of queries have arisen as a result of this series which I will elaborate on as payrolls are not the most interesting thing to dwell on for two whole pages.

Passwords

The first bone of contention is that of passwords. Are they really an effective deterrent or just an irritation for the authorised user?

Passwords originally came in to prevent certain users gaining access to confidential information kept on the computers' files. In a mainframe or mini computer installation where all the files may be accessible by any terminal at any time, this is a valid constraint to stop employees finding out how much the boss gets paid. On a simple micro computer which only has floppy disk then passwords are irrelevant. How do you stop someone taking a peek (or poke) at a manual payroll? You lock it up. Very simple. Very effective. (Like Japanese car). Just do the same to your disks. Q.E.D.

Some people seem to get obssessed by the idea of 'one entry book-keeping' and integrating everything into one heap. There are certain problems in attempting this feat. The first is that it takes up tons of disk space – at least a M Byte which is more than many micros can offer.

The second is that if you are a limited company you have to have an audit done every year on your books and records. Auditors are fussy people and like to be able to see what has been going on in your business during the year. They will want to ensure that all transactions entered on the Nominal Ledger have been authorised and not put there by just any member of staff. By posting entries across manually it enables accountants to scrutinise entries for obvious errors such as a batch of invoices which have been posted twice.

While I agree that integration saves time, it can be very dangerous from the control point of view, and absolutely hideous if a serious clanger occurs in trying to straighten out the records retrospectively. So check with your auditors first before spending the cash.

And with that caveat, we end this series on How to Buy your Business System. If you've realised just how easy it is to be misled by spec. sheets and over-enthusiastic sales persons, then we've achieved our aim. Do write in with queries, or just to explain your own experiences of buying a business system – your letter could help someone else avoid a disaster!

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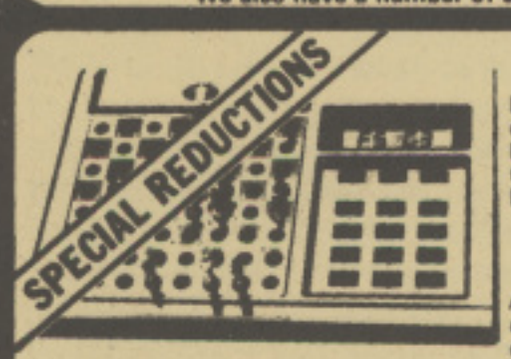

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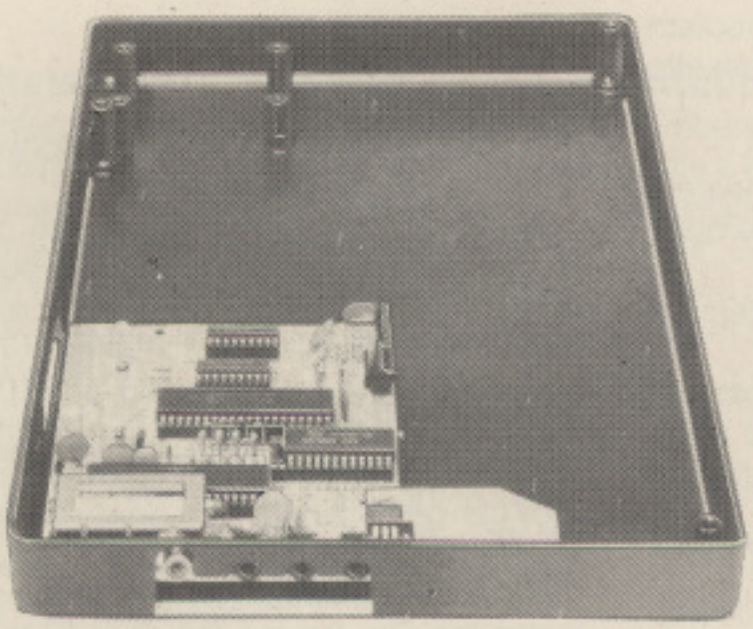

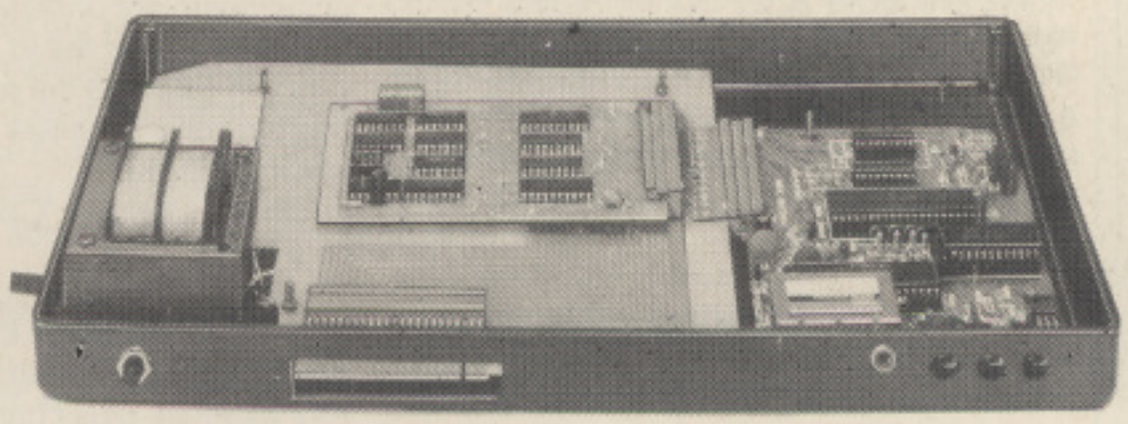

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READ/WRITE

PET snaps

Can you, or any of your readers, tell me about any ways in which a PET (mine is 8K, old ROMs) can be used in connection with photographic enlarging, black and white and colour?

Peter Shafe,
Altea (Alicante), Spain

We are going to have to pass this one over to the readers, since we haven't yet heard of anyone using a PET for this application. Anyone know better?

Here are a few suggestions, though:

1) One of the hassles of enlarging is the calculations that are involved: sizing and scaling, exposures and filter strengths etc. Obviously a simple BASIC routine could help out here.

2) Why not use one of the off-the-shelf database programs to catalogue all your negatives and prints? This would allow you to cross reference them under subject matter, location and date etc.

3) If you don't mind tinkering with a soldering iron, it should be possible to link your PET directly to the enlarger (via the User Port) to perform timing and control directly.

Medical computers

I read with great interest your article on the use of computers in medical practice. I would like to bring to the attention of your readers of a book that I came across and have found useful. I am a beginner in computers and this book introduces the subject in a very easy and concise manner.

The book is "Computers in Medicine – An Introduction." I obtained by copy for £10 from: Medical Computing Co., Suite 10E, 860 Fifth Avenue, New York, NY10221, U.S.A.

Dr. E Derik,
Belfast

Many thanks for the tip, Dr. Derik – we agree that books which successfully bridge the gap between computers and professions are few and far between.

You may like to know there is a magazine with just such an aim called Practice Computing *which is sent out free to G.P.s. Any doctors interested should write to: Paradox Publications, 39-41 North Road, London N7 9DP.*

Inflated values

Many thanks for the publicity for my newsletter, which appeared in the April edition of Read/Write under *Lateral Thinking*. Unfortunately a typo must have crept in somewhere: the newsletter is for *6800* users, not *68000*.

Much as I would like to be able to help the people who have written to me regarding the latter processor, I am afraid that such information is scarce at the moment.

T.K. Boyd,
Belmont School,
Feldemere, Holmburg St. Mary,
Dorking, Surrey

Texas drawl

I liked very much your review on the TI-99/4A. It showed that the 4A is not the rubbish some other mags make it out to be. Can we have more articles on the TI-99/4A or 4 please?

I. Scott,
Peterborough

BBC bashed

I read Guy Kewney's review of the BBC Micro in your June issue.

I don't agree; the BBC Micro will fail for lack of after sales service. I have a small problem with mine – either the recorder or the cassette or the micro are unreliable.

The BBC refer me to Acorn.

Acorn gave me the names of my 2 nearest dealers, one 50 miles away in Canterbury, one in Chelsea.

I phone Chelsea: "Can I bring the 3 items in for a test?"

Answer – did you buy the Micro from us? No – from the BBC. In that case we won't even test but only send the lot to the factory at your expense plus charges.

I would be without the equipment for at least a month and face an uncertain bill.

From Acorn I also have a circular – conversion of BBC A to B can only be done by our dealers, cost £125.

I regret I fell for the BBC and promises which are not forthcoming. The BBC are only interested in entertainment – not businesslike after service.

I forecast the BBC Micro will be a flop because of all this, irrespective of how good it might be.

G. Mayer,
Orpington, Kent

Though many users have written to us expressing satisfaction with the capabilities and value-for-money of the BBC Computer, Mr. Mayer, yours is not the first complaint regarding servicing and repair we have heard.

The brief history of the microcomputer has shown that one of the most effective things you can do is join up with one of the independent BBC user groups such as BEEBUG or LASERBUG (see Hotline), not only for technical advice, but also to accumulate some collective muscle with which to apply pressure to the manufacturers/sales organisations.

Anagram cracker

After keying in all 12K of "Anagram Cracker", I feel I must congratulate Bob Chappell and yourselves on two things; firstly, an informative program when compared with the popular 'space' type ones and secondly while allowing for the very small amount of conversion to another machine, that it was correct in format, was well documented and was correctly printed. One of the few magazine programs which ran first time after one necessary conversion was spotted.

The machine used was the UK101 using the CEGMON monitor, new BASIC 1,3,4 and extra BASIC 5, and the following points may be of interest to other 101 users or anyone seeking conversion to other machines. The only major fault was in the statement in Line 70 in which S-T can result in 0 (zero) and LEFT$(Str$,0) is not supported on the 101 producing a 'trying to reference a non-defined array' error. Adding a penultimate line of:

```
68 IF S-T=0 THEN W$=M$+N$:GOTO 75
```

will solve the problem.

For a 16 line display UK101, Line 420 should read:

```
IF RC<11 THEN RETURN
```

and finally a few of the program lines were too long and had to be split.

The program will not run on the original BASIC 3 due to its string handling bugs but with the new Premier Publications replacement will create the look-up tables in 70 seconds for a 7 letter word and 95 for a 10 letter-word. CEGMON and BASIC 5 support a fast Screen Clear and the GETI$ statements but they can be obtained more slowly by the original screen clear statement and keyboard input routine respectively. As a point of interest the File Saving Routines of the new BASIC 4 results in a LOAD time of 6 minutes at 300 baud compared with the 9 minutes of the original BASIC 4. (P.S. I get no commission from Premier Publications!)

Finally thanks for an interesting magazine that does not try to talk down to BASIC users, although knowledge of other languages is useful, and for information on a wide range of subjects.

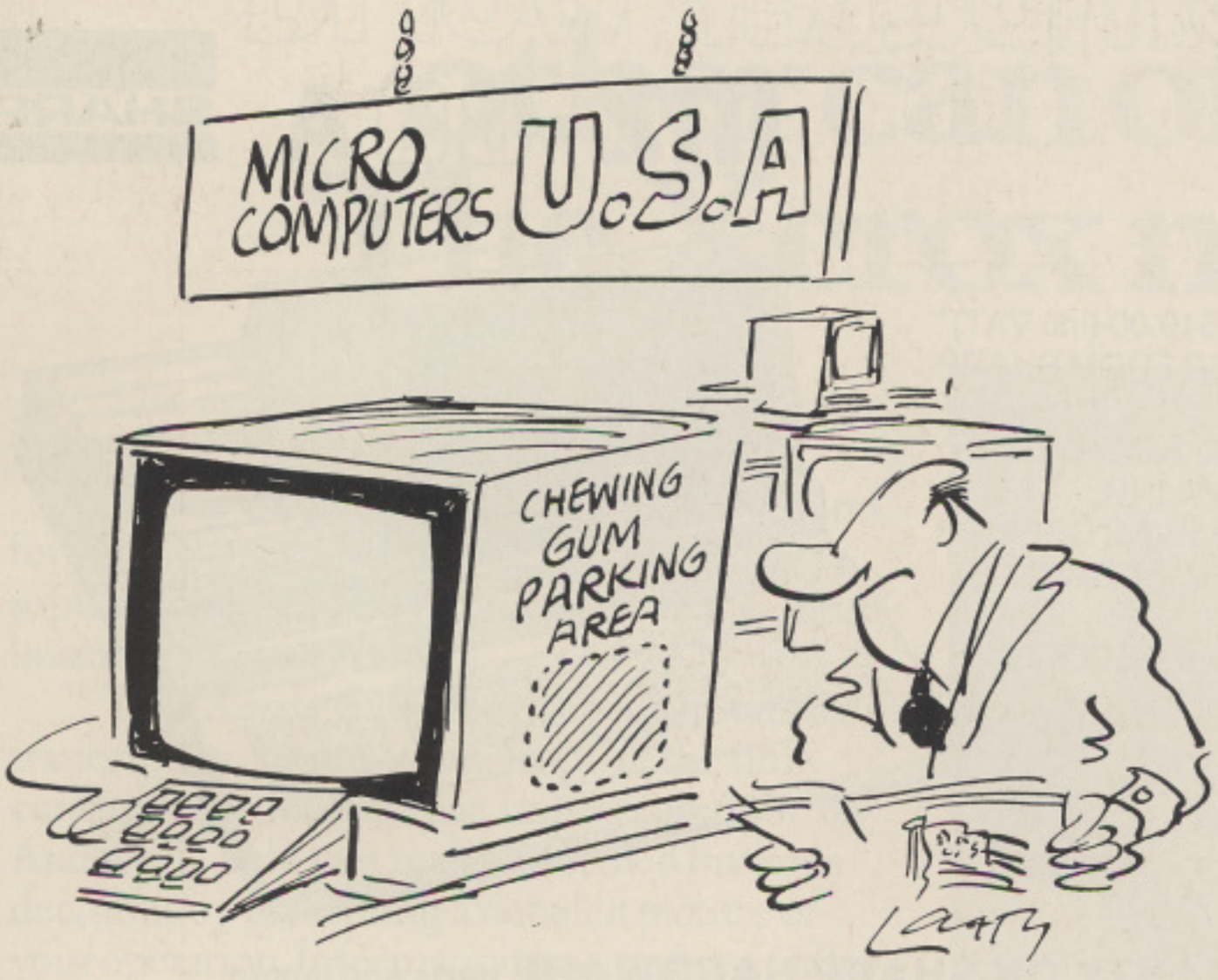
N.L. Smith,
Stoke-on-Trent

All credit must go to Bob on this one, for a very well thought out program (several readers have commented on this listing). We do try, however, on all our listings, to avoid any program structures that would make conversion to another machine difficult.

The UK101 is not a machine about which we receive a lot of correspondence – do we have other users amongst our readership? Write and let us know.

READ/WRITE

The Editor welcomes your letters, but if you require a personal reply please enclose an S.A.E.



Intellivision 1

I am interested in starting computing as a hobby but with the number of machines now on the market the choice is bewildering.

My main interest is for computer games. I have an Intellivision TV game at the moment, and it is into this field of computing I would want to venture.

The graphics on my TV game are very good and I would like to know if there are any computers on the market which are equal to or better than the Intellivision sort. For instance, would the BBC microcomputer give me the graphics I want?

J. Whiting
Nailsea, Bristol

The graphics on the Mattel Intellivision offer 16 colours on a resolution of 192 x 160 picture elements or 'pixels'. Quite a few microcomputers can offer comparable graphics, including the Atari 400, Texas TI99/4A, BBC A and B, and with limited colour, the Commodore VIC and Sinclair Spectrum.

We would point you specifically in the direction of the Atari and Texas, since both have been designed specifically for the home market – with a heavy bent on video games. Both have a good range of plug-in cartridges, and both have graphic commands which facilitate writing your own games.

Atari's system is called Player-Missile graphics and allows you to create objects, move them about the screen and detect collisions between them. Texas' version (which requires the additional plug-in TI Enhanced BASIC) is called 'Sprite' graphics and allows objects (known as Sprites) to pass in front of or behind others.

Intellivision II

I understand that Mattel are to shortly introduce a keyboard which will turn the Mattel Intellivision Video Game into a full home computer. Could you please provide me with any details of cost, availability and technical appraisal of the resulting computer.

G. Robson,
Camberley, Surrey

The truth of this matter is that Mattel have been 'about to introduce' a keyboard and BASIC language for the Intellivision video game machine for at least two years, and indeed, that promise has been a selling point for many owners. After all, the graphic capabilities and game-control handsets are superior even to Atari's V.C.S. so the addition of a home computer facility would make it a very attractive machine.

Apparently, a keyboard has been released in the States at around the $400 mark which would translate to £300 by the time a British power supply had been installed. Obviously this is too expensive to be a best seller, so our guess is that Mattel are developing a cheaper (say £100) keyboard plus BASIC unit – though it could be the end of the year before it arrives.

Meanwhile, there would seem to be a captive market ready and waiting for some entrepreneur or small hardware company to develop an independent keyboard. Any takers?

Teletext

I intend purchasing a Model B BBC Micro for home and personal use.

I do not have Teletext on my home TV and would like to have this for its own sake. As I understand it, however, I will also be able to "incorporate" information from CEEFAX etc. into my computer programs – is this correct?

I presume I could replace my present TV with a model which incorporates Teletext, or alternatively I could purchase the BBC Teletext Receiver (price £166) or some similar type of adaptor/peripheral. Assuming there is little for or against the choice from the economic point of view, is there any advantage or disadvantage from the technical and operating point of view in choosing the BBC Teletext Receiver?

E. Cummins,
Wilpshire, Nr. Blackburn

Yes, it would be very much more beneficial to purchase the Teletex add-on to the computer (assuming it gets to market, that is), because this will allow you to make use of the information extracted from Teletext pages, in your programs.

An ordinary Teletext TV set won't permit this.

Though you would need to write your own software, it should be possible to develop some quite sophisticated applications which make use of teletext.

One idea is a Portfolio Management System which alerts you to significant changes on the Stock Market. Or a program which uses sports results to predict the outcome of future games.

Incidentally, we would be very interested to hear from readers who have ideas for computer applications which involve Teletex also.

Neater flowcharts

D. Larder (Read/Write, June 1982) may like to know that the Linex brand of templates about which he enquires, is well known and widely stocked by drawing office suppliers (see Yellow Pages). The flowchart template to which he refers is "Electronic Data Processing Template", details as follows from the current Linex catalogue, prices from a local stockist:

No. 1175 – symbols standard size (i.e. PROCESS rectangle = 30x20mm), £3.75 + VAT
No. 1178 – symbols 0.7 x standard size (21 x 14mm), £4.66 + VAT.
No. 1168 – symbols 0.5 x standard size (15 x 10mm), £3.55 + VAT.

The symbols are described as ISO 1028 BS ANSI, and appear virtually identical with those on the Inmac template at £5.20 + VAT.

D. T. Hartley,
Wilmslow, Cheshire

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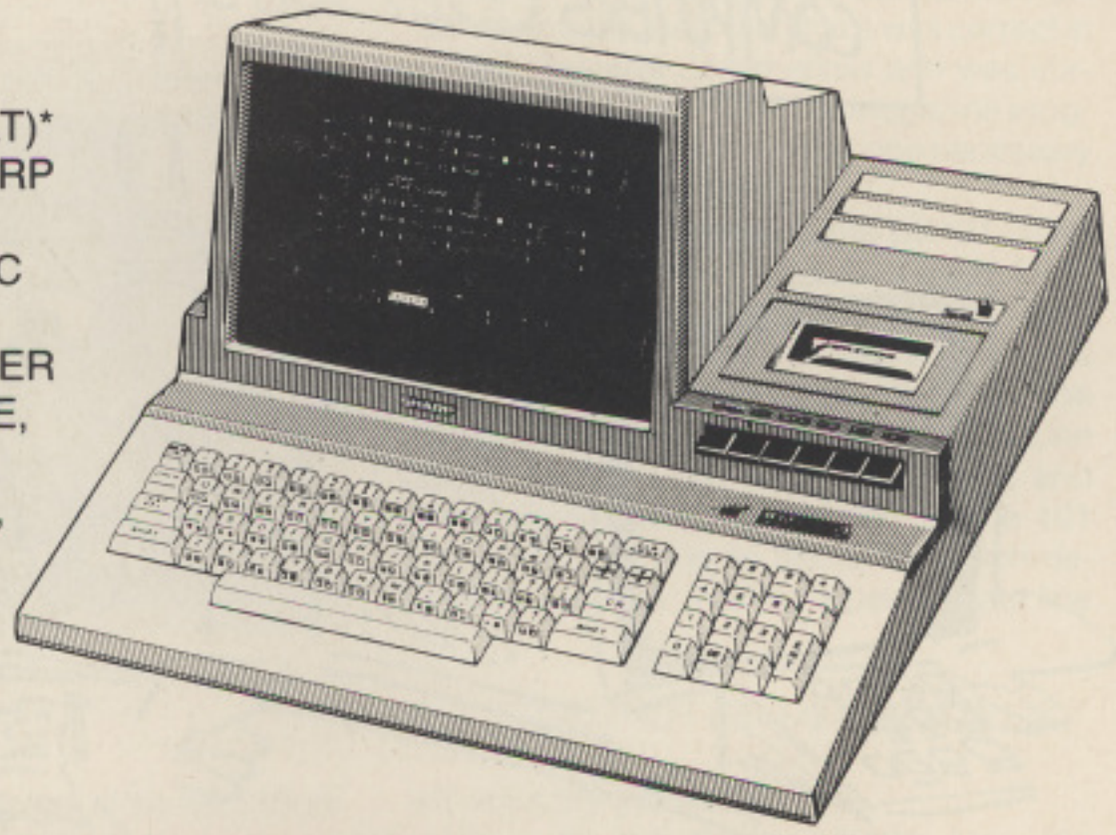
BANK LOAN, MORTGAGE
BASIC TUTORIAL - BASIC TUTORIAL 1
- BASIC TUTORIAL 2
- BASIC TUTORIAL 3
- BASIC TUTORIAL 4



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Mighty Mini Maker Markets Micro

At *MicroComputer Printout*, we pride ourselves on the currency of our newspages – after all, the microcomputer market is a rapidly changing field and one can't afford to be three months out-of-date, like most of the other micro mags. So imagine our horror when we discovered that we had missed one story by *25 years!*

You see, according to the Digital Equipment Corporation (the Big Baron of mini computers), *they* invented the personal computer a quarter of a century ago. It had a colour graphic display, could play music and even had joysticks for playing video games. The kids just loved it.

Only two problems prevented DEC from pre-empting the Apple by 20 years. First, far from being a desktop machine the PDP1 needed several large rooms for accommodation and at an asking price of $120,000 it was somewhat above the average family's means.

Since DEC have had such a long-standing experience of the personal computer business, why, you may wonder, are they so late in bringing their own micro to market?

"We aren't late," retorts DEC's Boston-based President, Ken Olsen. "We were just waiting until the time was right." And in case you thought our Ken was being somewhat less than candid, he graciously concedes that "until recently we've been too busy. Now with the help of the economy we have the opportunity."

This broadly translated means "The future of the minicomputer market is looking extremely doubtful. So now that a micro market has been opened up by Commodore, Apple, et al, we might as well muscle our way into it." So exactly what impact are DEC going to make on the micro market?

Allow me first of all to introduce the four machines they will be bringing out at the end of this year. All are extremely well designed ergonomically, with free-standing low-profile keyboards, and compact high-definition VDU's which can display 24 lines of 80 or 132 characters.

The computer itself with disk drives is housed in a large floor standing box which can rest horizontally or vertically on, or indeed under, the desk. The internal design is modular, so that with the aid of the graphic self diagnosis program, any user should be able to replace a faulty component with no tool more sophisticated than a ballpoint pen. Not that that should be necessary, since DEC will be offering a one-year on site warranty, and a variety of different service contracts thereafter.

At the bottom of the range is the *Rainbow 100*, designed to attack the IBM Personal Computer. With twin processors (Z80 and Intel 8088) the *Rainbow* will be able to run any software written under CP/M, CP/86 and MSDOS, and can apparently automatically sense and switch between them as the applications program requires. Price starts at about £2,200 with expansion up to 256K RAM, 5Mbyte hard disk and colour monitor all costing extra.

The *DECmate II* is really an upgrade and restyling of their *DECmate I* and is aimed at the integrated (paperless?) office – with word processing the main emphasis.

The professional series (325 and 350) are based on DEC's own processor, the F-11, based on the PDP-11/23 which is found at the heart of more than a few mini computers. They even incorporate telephone management systems, which can dial numbers and deliver or record digitised speech messages.

From where we stand, the specifications offered by DEC are almost irrelevant. What will count is the hardware and software back-up they offer, and the sheer weight they place behind the marketing.

Something for the future, perhaps, but well worth watching. We'll keep you posted.

C.A.D. for CP/M

"Designed by computers, built by Robots." Remember that ad?

Now you too can design cars, buildings, perhaps even robots, in the privacy of your own home.

The sinister-sounding KGB Micros of Slough have achieved something of a breakthrough with *Micro Designer*. Managing Director Sandy Saunderson says it is the first real time computer-aided design system running on the industry-standard CP/M operating system.

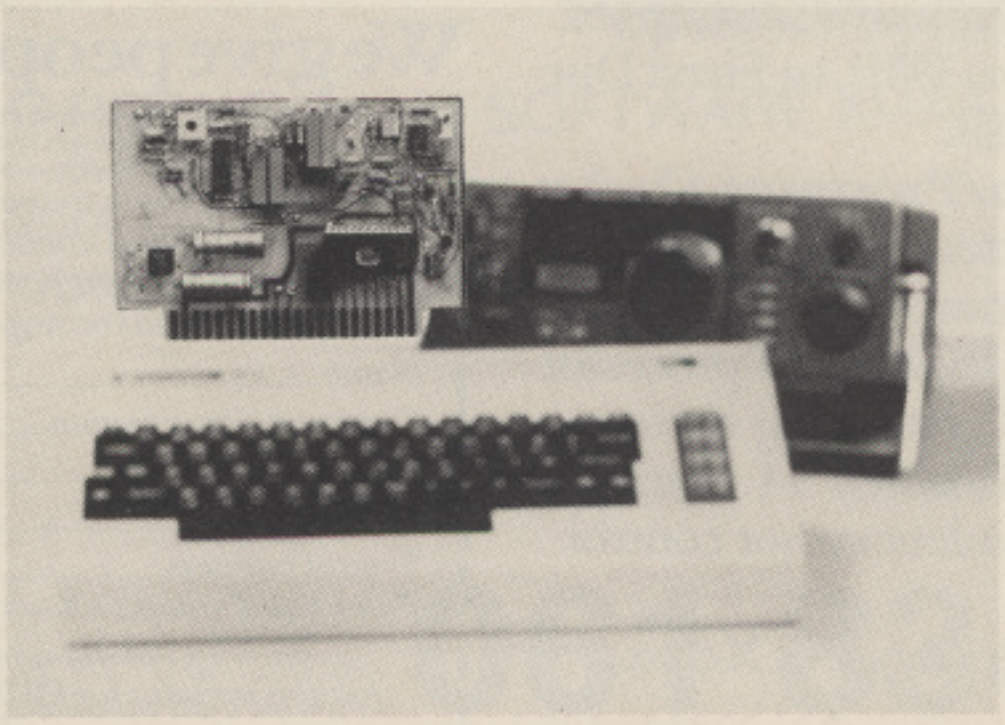
At £2,500 for the software it also cuts the cost of C.A.D. in half.

Using *Micro Designer* drawings are produced from instructions entered via the keyboard, or through direct feedback from the plotter, or via separate digitizer pad of any size. Full use of pre-prepared symbols (useful for circuit design if that is your bent) and part drawings can be made to speed up the creation of complete drawings.

A vector graphics screen is available for checking and editing parts of a drawing. KGB say first class drawings can be produced from the basic system without the aid of a hi-res screen, though personally I shouldn't care to try.

The KGB are headquartered at 14 Windsor Road, Slough, Berks. Tel: 38310 and ask for Boris.

Mayday!



How's this for a nice, clear picture? The blurred object in the foreground is a Commodore VIC-20, the blurred object in the background is a standard 'ham' radio transmitter/receiver. The crystal clear object in the middle is an interface between the two which is being sold by Computer World, Hilvertsweg 99, 1214 Hilversum, Holland. (Tel: 31-35-12633)

The idea is that it allows you to use VIC's keyboard to send messages – automatically translating text to morse code or RTTY as desired, or as Computer World put it: "Vee kaan now efen send programs betveen ham radio ensusiasts!"

by Julian Allason

Electronic camel gets the hump

If the camel is a horse designed by committee, what is the *NewBrain*?

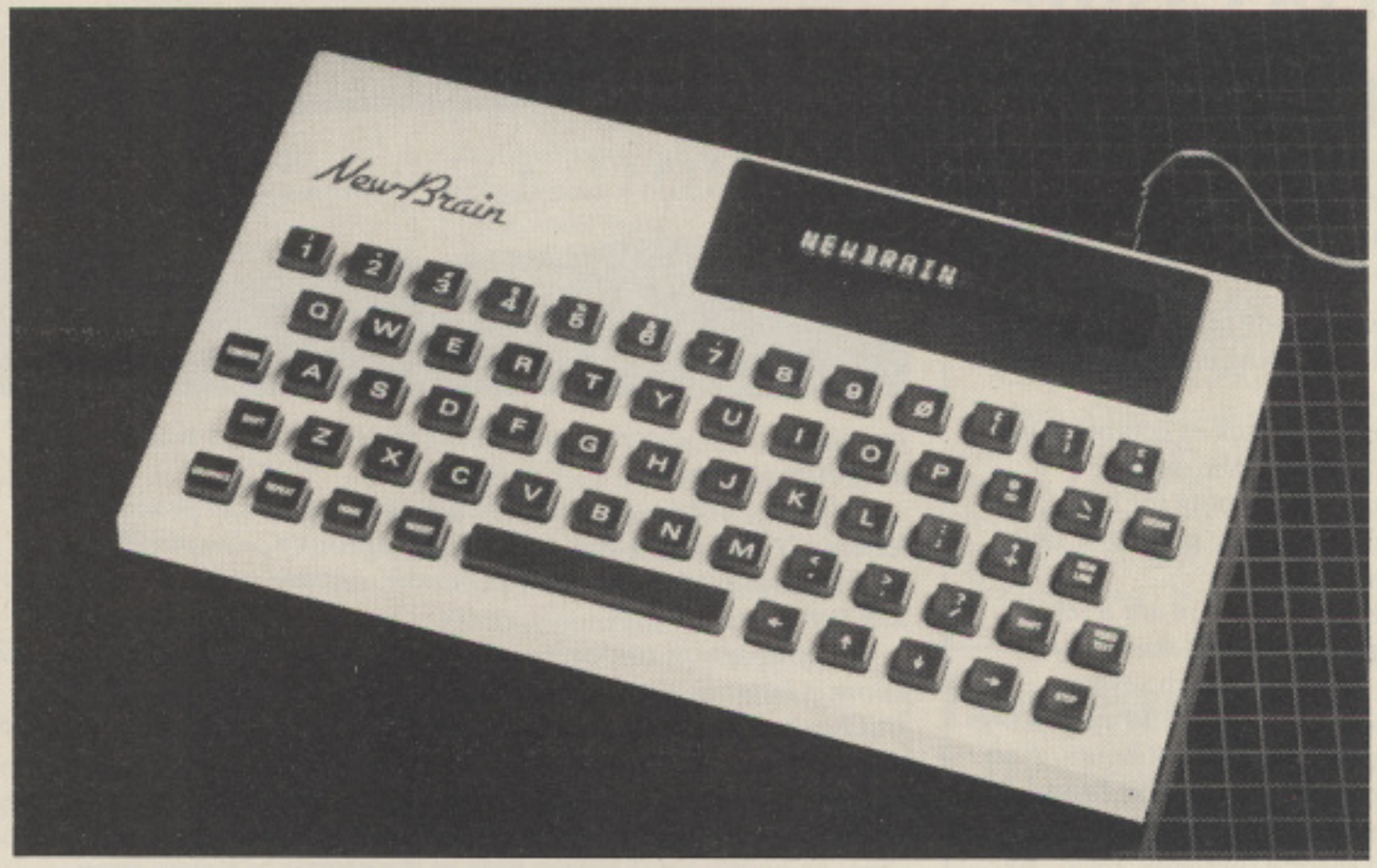
Grundy Business Systems have just relaunched the computer originally developed by Newbury Laboratories which, after acclaim for its innovative design, promptly disappeared from sight.

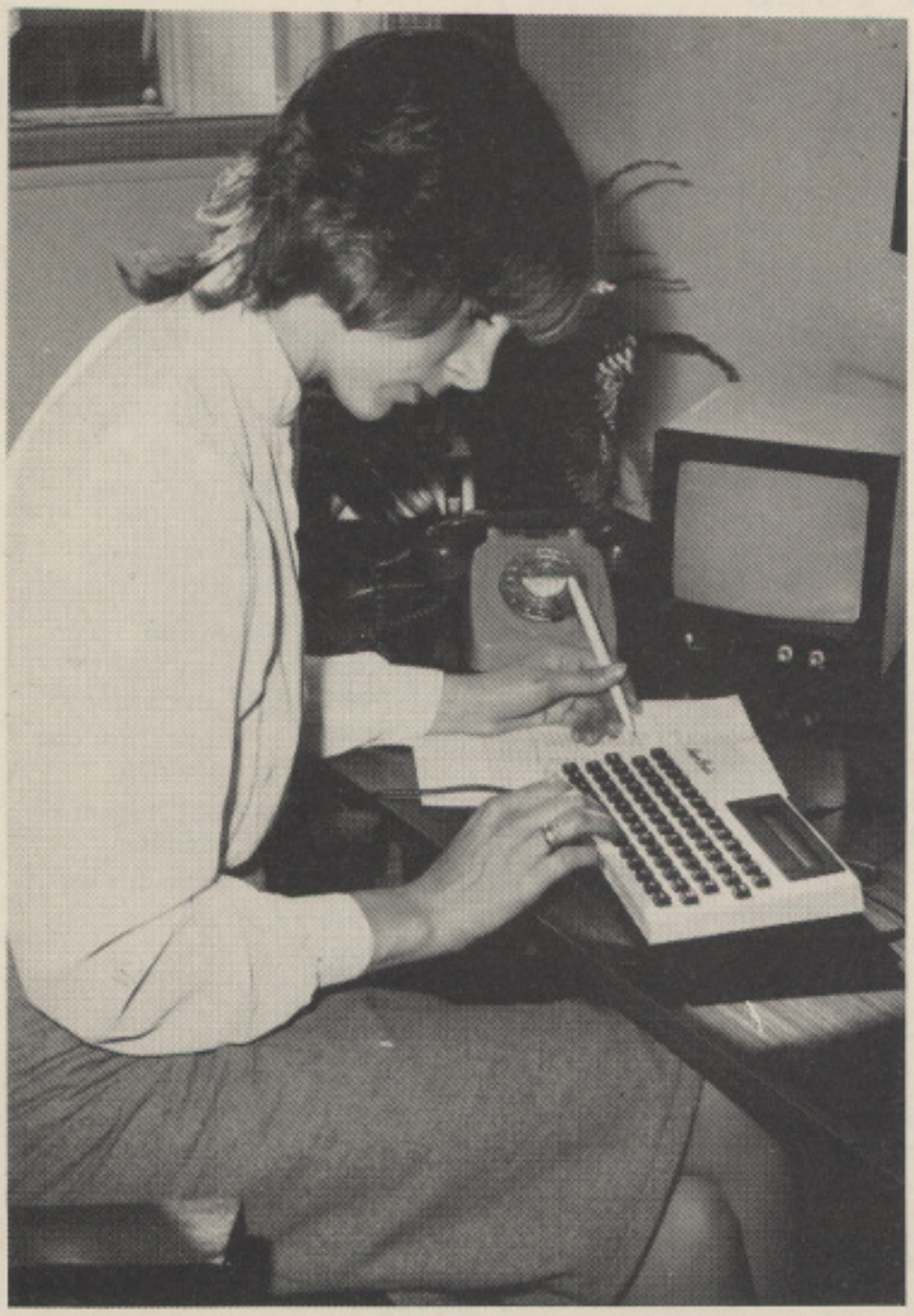
Now that the *NewBrain* is back the same industry insiders who applauded it two years ago are calling it a jack-of-all-trades and master of none.

Developed originally by Newbury Laboratories (an NEB backed company), the *NewBrain* looked like a very clever idea at the time; just the kind of shot in the arm needed to revive the fledgling British microcomputer industry.

A portable microcomputer, well-constructed with a usable keyboard and 16-character display, the *NewBrain* was intended to run BASIC programs on the plane or train, and then plug into the TV at home or office for desktop power.

Yet despite the fact that the *NewBrain* was the BBC's first choice for a machine to support their TV series – The Computer Programme – the machine was so beset by design and production problems, that the whole circus had to be sold off to Grundy Business Systems, specially formed division of a large beer-barrell concern. Meanwhile the BBC opted for a design by Acorn as an 'eleventh hour' solution.





Now, two years after its original showing, and after "complete internal re-design" (Grundy's words), the *NewBrain* is being re-launched.

Perusal of the spec sheet reveals one Z80A microprocessor, 32K RAM, 24K ROM which includes a BASIC interpreter ('designed to emulate Microsoft with a bit more on top') and a *very* impressive screen editing system.

Model A costs £233 (inc. VAT), while the AD (which includes the 16 character display) costs £267.50. Both can drive a domestic TV or monitor, though the latter is recommended to take full advantage of the display facilities. The screen can be software switched between 40 and 80 columns, and both are made very readable by the 8x10 dot matrix.

In addition to the block graphics (the *NewBrain's* character set also includes the Greek alphabet for mathematicians, and a Chinese copy of the PET graphics), the *NewBrain* offers High Resolution as standard. *(A full technical and user evaluation is scheduled for the next issue.)*

It is hard to see exactly which market Grundy are aiming the *NewBrain* at. Without colour and sound, it is unlikely to appeal to home users. There *is* a market in schools for a medium-priced physically compact unit that's good for programming. The *NewBrain* also scores well on communications – with two high speed RS232 ports for connecting to modems, printers, etc., and plans for a networking system to allow several *NewBrains* to share common peripherals.

But Grundy's heart seems set on the business sector – and already they are signing up OEM deals – notably one with pharmaceutical giant, Vestric, who will use *NewBrains* as order entry devices in retail dispensaries.

The problem is, however, that *NewBrain's* real strength – its portability – is nullified by the fact that it needs a mains power supply. Though a £60 battery pack will be available shortly, it will only supply one hours' worth of power – enough to 'get you home', or as Grundy put it: 'see you through a power cut'.

Once a proper battery power supply, and a range of quality applications programs become available, *NewBrain* could be a winner – until then we would place it firmly in the 'also ran' category. **R.P.**

VICar's delight

I have to say that raffles, fetes and bazaars in aid of Church Hall renovation funds aren't exactly my cup of tea. Not for me the dubious pleasure of fighting with one's neighbours to buy back the same junk you gave away last year, all to make the financial barometer at the entrance gate climb a couple of millimetres!

But I have to admire one Mr. (Rev?) Clayton of 15 Meadowscroft, Euxton, Chorley, Lancs, who, in order to raise money for his church hall, has taken to selling VIC programs. For £9.95 you get 18 programs covering such secular subjects as Hangman, Killer Comet and Betting. Write for more details.

HOTLINE

Word processing on the cheap

Can somebody please explain why word processing programs are so expensive?

It can't be lack of competition.

Surely someone out there thinks there is room for an inexpensive word processor that really works?

OK. I know there are a few el cheapos about, but the ones I have seen suffer such severe limitations that you end up junking them after a couple of hours. And I won't even mention the question of documentation.

On second thoughts, I will. By and large it is atrocious. The *Wordstar* manual is positively impenetrable in places. Lots of places. And this the best selling word processing package in the world.

A ray of light has appeared on the horizon, however. Two rays to be precise.

Ray number one is *Wordform*, a PET/CBM word processor that performs 90% of the functions of the expensive programs according to author Ted Landsler, (I think he is talking about *Wordpro* and *Wordcraft*). It is entirely written in machine code – so no hanging about – and it costs a modest £75 plus VAT.

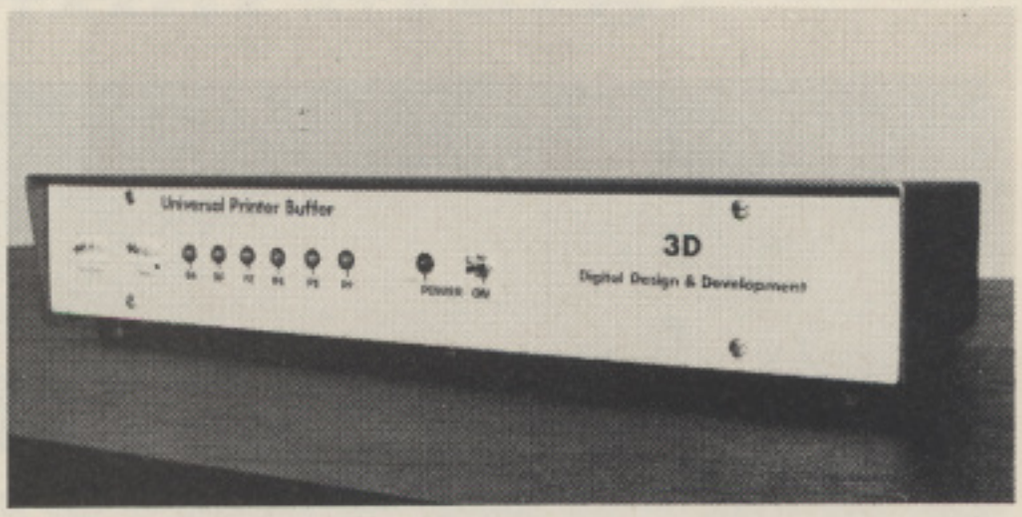
Landsler says he designed it to present the illusion of a fixed page of paper viewed through a window which is moveable across the length and width of a page. Entering text *Wordform* simulates the action of a typewriter, whereby the cursor position remains fixed and the page advances across the screen. Clever idea when you think about it.

But if you want to get *really* clever, Landsler has a new program called, not unreasonably, *Wordform II*. It excels at handling blocks or columns of text.

A column of figures can easily be moved wherever it is required, which should appeal to the more creative accountants amongst you. I was also intrigued to see that one block of text can be overlaid over another. *Wordform II* still costs half the price of the competition. That's to say £150 plus VAT.

Landsoft do a useful brochure which you can get from them at 28 Sheen Lane, London SW14. Tel: 01-878 7044.

Not so silly buffer



It isn't much good computers getting faster and faster when printers are getting slower.

Slower? Well, yes. Last year a printer capable of producing letters of typewriter quality was so outrageously overpriced that sensible folk settled for a matrix printer, capable of hammering away at a fair old rate.

Nowadays, as students of our 'Cheapest Daisywheel' column will know, a letter quality printer can be had for £600 or is it £500 now? But however pretty the output, few of these printers could be described as fast.

The answer is an intelligent data buffer with enough memory to store whatever it is you need to print, so that you can get on with some computing at the same time *as the printer hammers away.*

It is true that some printers do provide some data buffering of their own, but usually only enough for a few lines.

I rather like the look of 3D's Universal Data Buffer. It has its own 8-bit microprocessor and a static RAM buffer that can store up to 8K worth of characters. Data can be input or output in either serial (RS232C) or parallel forms.

It costs £250 from 3D at 18/19 Warren Street, London W.1. Tel: 01-387 7388.

74,000 million year code

The dongles could be back on the drawing board by the time you read this.

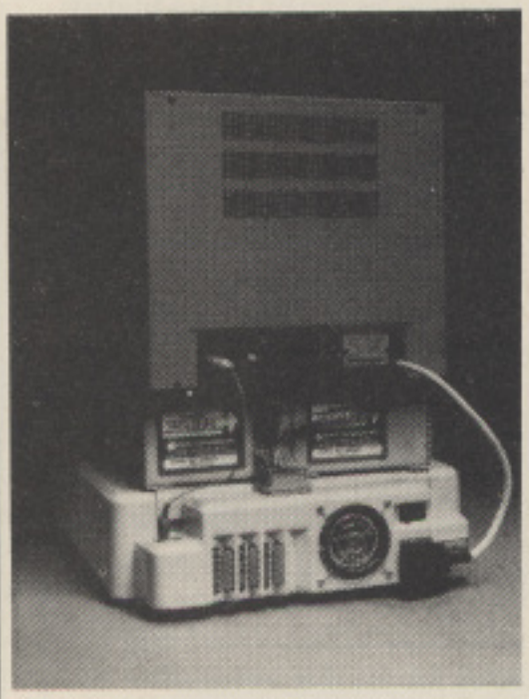
For the uninitiated, a dongle is a protection device that is supposed to prevent program piracy.

I say 'supposed to' because the ingenious John Chew of Kingston Computers has found a way of circumventing the dongle. His motives are entirely honourable, he assures me. And indeed Kingston are now producing their own souped up dongle system called *Secure*.

It consists of a slim encryption key which plugs into the parallel user port of the computer, a pair of cassette programs – one for the various models of the PET and the other for the VIC-20 – and a simple manual. *Secure* costs £39.95 + VAT from Kingston at Electricity Buildings, Filey, North Yorkshire. Tel. 0723-514141.

Chew calculates it would take a PET 74,000 million years to crack his encryption key. I bet some crafty programmer will do it in half the time.

Cool it



Is your Apple hot and bothered?

A cool and soothing Applefan could be the answer. Not only will it prevent your chips from frying, and boards from baking, but it will discreetly dispose of the spaghetti junction found at the back of even the best mannered Apples.

Data Efficiency of Finway Road, Hemel Hempstead can kit you up for a cool £68.88

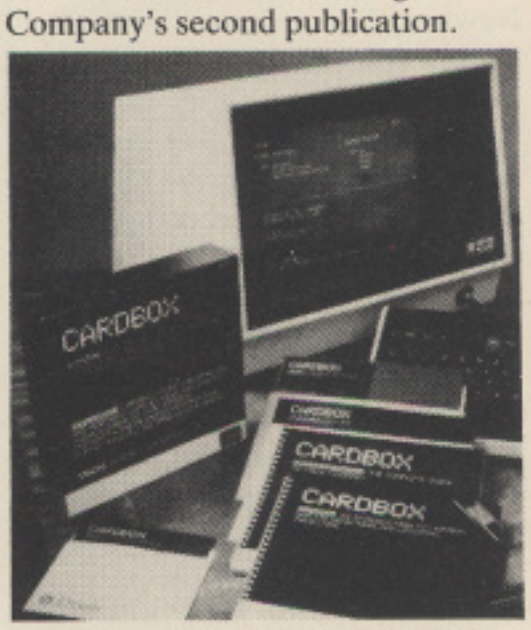
House of cards

Desperate Dave Tebbutt sat in his bunker surrounded by 64,000 filing cards. He looked worried.

"I think the cat is under there somewhere," he said pointing to a pile of cards large enough to have concealed a small hippopotamus. "Have a seat."

This was the rehearsal of the *Cardbox* launch, and clearly things weren't going well.

"I think I shall dismiss the graphic designer" muttered Dave through his beard. Cheered up by the prospect of the firing of the author of the 64,000 card idea Dave gave me a demo of the Caxton Software Publishing Company's second publication.



"*Cardbox* is best described as an electronic card index system in that it displays individual records on the computer screen in a card-like way," he explained.

And so it is. The *Cardbox* program acts like a sieve, sifting through all the records until it sifts out all but the ones that match your precise requirements.

In a few minutes we had an embryonic library index up and running. "Let's find all the books mentioning sex in the title," suggested Dave helpfully. The system duly displayed details of *Chicken Sexing for Profit and Pleasure* published by Kewney AutoGuides, Bognor, 1958. Critical Evaluation: Negative. Cross reference to Poultry Farming and Genetic Dysfunction. Hmm.

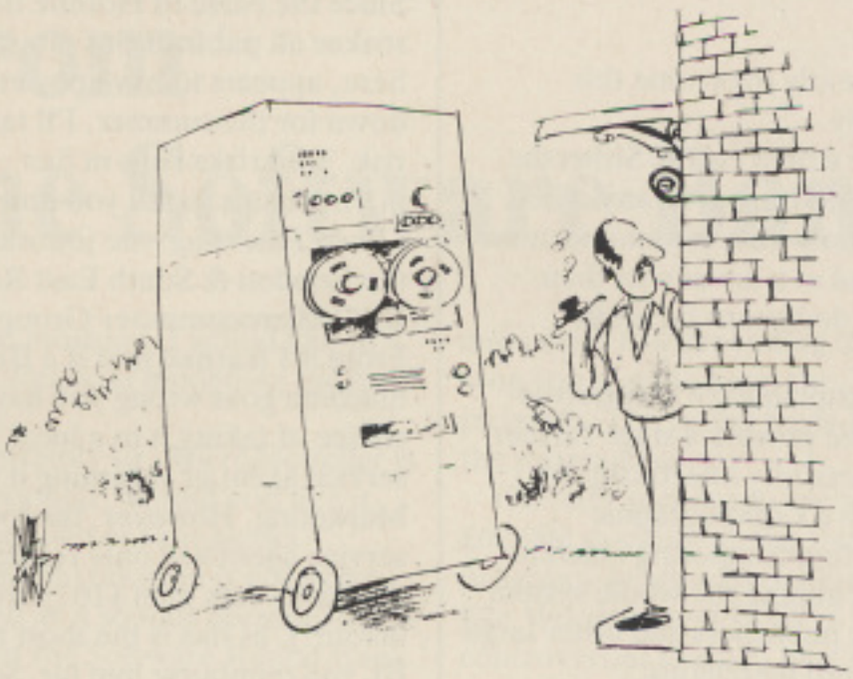
Database snobs may wish to reserve judgement on *Cardbox*. But I think it is a winner. For one simple reason. It is the first information handling program I could understand – and the manual's a model of lucidity too.

CP/M users will find it at their dealers price at £155 + VAT. Contact Caxton at 10-14 Bedford Street, London WC2. Tel: 01-379 6502(!) for the name of the nearest one.

If you ask for details Desperate Dave will send you, amongst other things, a list of 101 uses for *Cardbox*. Look at Number 89 and you'll discover what happened to the cat.

by Julian Allason

Mailshot madness



"Marjorie! It's a personal call by 'Reader's Digest'."

If anyone can be said to have soured relations between humans and computers, it has got to be Readers Digest.

Week after week their mighty IBMs despatch millions of pages of unsolicited but deeply wonderful offers, each unsubtly personalised with the names of the lucky recipients.

Encouragement is the last thing they need, you would have thought. But no, Apple Corporation have signed a two year co-operation agreement with Readers Digest.

Apple will provide computer training and technical support. Readers Digest will write educational programs.

Post persons have been warned.

Instant recall

At the risk of further ribbing from the technofreaks on our staff, I would like to tell you about the most useful program I use. It is what you might call a very tiny database, although said technofreaks naturally insist that it is no such thing.

Most popular microcomputers are supported by a variety of plug-in ROM chips offering extra BASIC language commands and the like.

The Daddy of them all was the *Programmer's Toolkit* for PET which is still available from Zynar's dealers, starting at £29 + VAT. Many of these utility chips offer a FIND command.

Type FIND WOZNIAC on the screen and a routine hunts right through the program currently in the RAM memory, and displays on the screen any lines containing that string of characters.

Since FIND will hunt for any string, you could equally easily demand that the computer FIND WOZ, with the same result. Naturally if a Mr WOZZAT also featured in the listing, his name would be scouted out too in response to this request.

As a journalist, I have a large list of contacts, to whom I spend much of the day gossiping; this is known as investigative reporting. Keeping a written addressbook up to date and legible is not easy.

My program consists of a series of lines like:

```
100 MARTIN LEGLESS
    BANKS  INFOMATICS 01-
    439 4242 JOURNALIST
```

Details of the wonderscribe could be recalled by typing FIND BANKS, LEGLESS, INFOMATICS, or if I wanted a list of *all* hacks, JOURNALIST.

Sophisticated? Non. Useful? Oui.

Homework Eliminated

This acronym business is really getting out of hand. First we had BASIC, which we were persuaded stood for **B**eginners **A**ll-purpose **S**ymbolic **I**nstruction **C**ode, then some joker decided that PET meant **P**ersonal **E**lectronic **T**ransactor. Now a press release has landed on my desk announcing, would you believe, FIASCO (**F**ully **I**nteractive **A**lgebraic **S**ymbolic **CO**mputing).

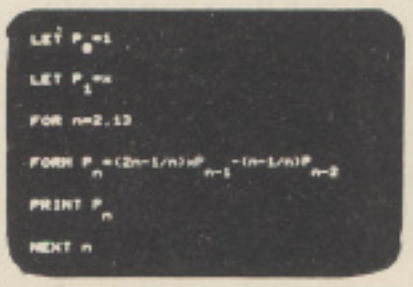
Now once you've got over the name, FIASCO (which costs £80 + VAT and is available on cassette or disk for all PET models), is a very interesting product. It is really a programming language which handles algebraic expressions rather than pure numbers. As the screen picture shows, subscripts and powers are shown correctly.

Aimed partly at the education market, FIASCO could be every schoolboy's dream come true: no longer need you be bogged down in quadratic equations, integration and polynomial expansions.

The designer assures me that the main use is as a teaching aid, or for professional use in "approximate analytical solution of non-linear differential equations."

Personally, I think he has invented the long-searched-for 'homework eliminator'.

Schoolboys of all ages are directed to: MacMicro Ltd., Beaufort House, Shore street, Beauly, Inverness. Tel: 0463-712774.



Tomorrow has been cancelled

Ahem! A slight problem has just arisen.

According to the Datapoint Corporation, an illustrious body, of whom more anon, the micro revolution is about to be cancelled. Ditto the Electronic and Paperless offices. Even the Office of the Future could be under threat.

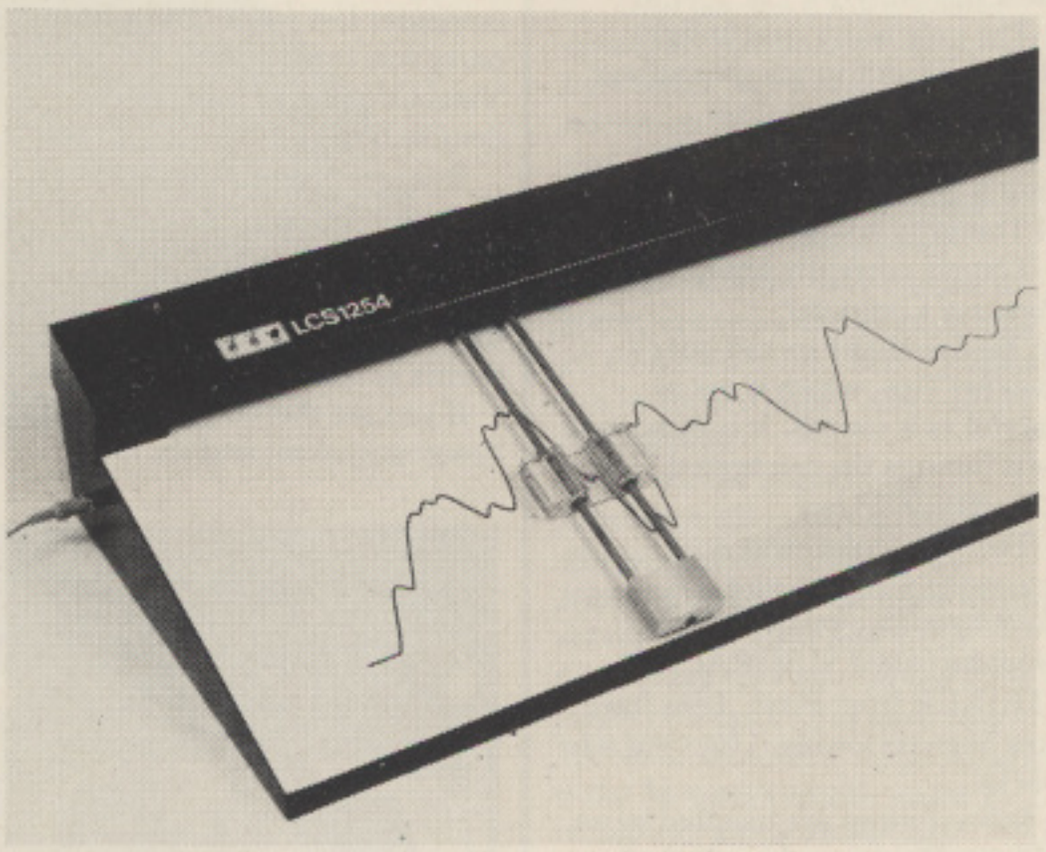
The difficulty, it seems, is that executives are not prepared to use keyboards. According to Datapoint's international and very expensive researches, the modern executive considers himself above typing.

In case you find your credulity strained by news of this sudden burst of status sensitivity, I should perhaps explain that Datapoint are in the business of selling alternatives to keyboards.

Indeed, release of these findings coincides with the launch of a new pen-shaped stylus and pad for use with their colour graphics systems.

Marvellous what a bit of careful research will reveal.

Danger Boffins at work



There is a theory that computer manufacturers always highlight the machine's weakest features in their advertising.

A curious example of this surfaced in promotional material from Linton Computers this month. The press release was headed 'New Graph Digitiser has switchable resolution of .5 and 1mm'.

Now, as graph digitisers go, this is not brilliant resolution. But reading on I learned that the new device is "by the far the most economically priced instrument of its type."

*But you will have to ring Linton on 0223-892656 to ask the price as they forgot to include it.**

*OK you guys, it is £1862 + VAT. In the great tradition established by 'The Cheapest Daisywheel in the world', we shall now no doubt be inundated by news of even cheaper graph digitisers...

Sirius reads typewriting

Visitors to last month's Hanover Trade Fair gazed in awe as typewritten letters fed into a document reader appeared on the screen of a Sirius 1 computer.

London dealers Zenithplan had hitched a Mitsui document reader to a Sirius running the *Wordstar* word processing program. The contents of each typewritten sheet appeared on the computer's screen pretty well instantaneously. The act of transmitting data to the Sirius automatically opened a file under the *Wordstar* program, so the original document could be manipulated in the same way as any other record.

At present the system recognises up to seven different typefaces, including many of the IBM golfballs. For more details contact Zenithplan at 2-10 Capper Street, London WC1. Telephone 01-636 5364.

We have been toying with the idea of computerising all our records for some time. The principal drawback for us, as for doctors and many businesses, was the need to key in so much old material. Zenithplan's system could neatly overcome this difficulty.

Once stored on the Sirius the data could be sent to any other computer with a communications link, and at a lower cost than using a document facsimile system.

Zenithplan have themselves taken the process a stage further by successfully interfacing the Sirius to a Compugraphic typesetting/composing machine, and are aiming the whole system at book publishers and other large scale word merchants.

Theoretically there is now no reason why this column, bashed out on my trusty IBM golfball at home, should not be read into the office Sirius, sub-edited by the Editor to remove the libellous bits, and then sent direct to the typesetter.

Dunno what the union would think, though.

The BBC News

Since the curse of Hotline that strikes all publications plugged here, appears to have powered down for the summer, I'll take a risk. Two risks risks in fact.

The first is to tell you how much I liked *Laserbug*, the journal of the London & South East Region BBC Microcomputer Group. From it I learned that if a BBC machine goes wrong you have a choice of taking it to a local service agent or returning it to BL Marketing. However, the local service agent will only repair it if the cost is less than £10 (parts *and* labour!), as this is the most that BL will reimburse him for. Sending it back to BL in Kettering results in them forwarding it on to Acorn in Cambridge. *Laserbug* thinks the situation is far from satisfactory.

A subscription costs £12 for 12 issues from 4 Station Bridge, Woodgrange Road, Forest Gate, London E.7.

The second journal to be put at risk by my recommendation is *VIC Computing* which I plead guilty to having had some part in the founding of. It is now editted by the estimable Dennis Jarrett, the real author of our hilarious Cray 1 Benchtest last month.

Essential reading for VIC owners and anyone considering the purchase of one. VIC Computing costs £6 for a years' subscription from Paradox Publications, 39-41 North Road, London N7. Telephone 01-607 9489.

Wot, no micro?

An alarming revelation from a fellow micro hack – "We don't actually use computers; we only write about them" – prompted a micro-census of our office.

On the Editor's desk, undergoing the sort of tests for which you need letters after your name, the *Sinclair Spectrum* (thumbs up) and the *New Brain* (Jack of all trades, master of none). In the editorial 'Out' tray an *Atari 800* (great graphics; dunno about business though), and, lurking under a sandwich, the pocket sized *Sharp PC1500* (scientifically sensible).

Meanwhile the ravishing red haired Wendy is handing out serious punishment to the *Lintotype CRTronic* computer typesetter (the best there is) on which these pages are set.

The only evidence of Pam's presence are two feet sticking out from under the *Olivetti* (awful) word processor, and the occasional muffled oath.

My own desk is straining under the weight of the *ACT Sirius 1* (State of the Art), on which I am grappling with their "very user-friendly" SELECT word processor. There is also a *PET 4032* on which I have a tiny database, of which more anon.

Oddly enough it is the advertising department with their *CBM/Silicon Office* (superb) installation whose numbers crunch most smoothly.

The only white coat in sight (Inside Trader wears camouflage for "security reasons") is Tommy's; at least it *was* white until it got covered in a few pints of Tommy's home brew.

Tommy currently has an *IBM Personal Computer* (v. businesslike) spread out all over his Tips, which is not as painful as it sounds. It is rumoured he is hunting the celebrated ".1÷10=.001" bug.

The Art department are reviewing a bizarre new *VIC-20* (love/hate/love relationship) program called SUBSPACE STRIKER from Pixel. They have now been reviewing it for over six weeks.

Subscriptions are handled by an *ICL2960* (not user friendly and not ours) whilst an *IBM 360* (unspeakable) keeps our distribution under what is laughingly known as control.

Next month: The saga of the Editor's eyeshade, Apple's answer to the IBM P.C., and where Tommy put the Tandy pocket computer.

Computer on wheels

I was practically run over by a computer last week. The guilty party was Jeremy Rose driving Da Vinci Computers' mobile demonstration unit.

Rose visits potential customers in the London area with the van. Inside there is a telephone, a Commodore 8032 with 8050 twin disk drives, daisy wheel and dot matrix printers. And a bar.

If you are thinking of buying a business system, and are not a nervous passenger, you can dial a demo on 01-952 0526. Or ring Rose direct in the van on 01-882 6481.

I still think he ought to pass a driving test!

by Julian Allason

Rent-a-program from the Software Bank

"Good morning, I would like to rent a financial modelling program please."

"Certainly sir. *MicroModeller* is very popular. Would you like it for one, two or four weeks?"

This conversation is not as far fetched as it sounds because on July 1st the Software Rental Bank opens for business.

Once it does you will be able to test out programs before you buy. Should you decide so to do, the Software Rental Bank will waive the hire charge.

It is a mystery no-one thought of the idea before David Chesney. Here's how it works. Membership costs from £30 depending on how long you want to keep the program. The rental fee is 20% of the program's price.

Chesney reckons to spend £60,000 stocking up the Bank with programs ranging from best-sellers like *Wordstar* and *DMS* to more controversial releases like *The Last One*. They will kick off with 140 Apple II programs, and will add packages for the ACT Sirius 1, IBM Personal Computer and North Star Horizon.

Membership details from 58 North Street, Leighton Buzzard, Beds.

Heaven & Hell

Wherever computer folk gather it's seldom long before they begin telling jokes. Regular readers will know that my colleague, Rex Malik, is compiling the Official Computer Joke Book.

If you have heard a good one, write and let us know. I will send a copy of the book to the author of any we can use. Here is my entry:

You know the difference between heaven and hell?

Heaven is where the British are the policemen, the French are the cooks, the Germans are the engineers, the Italians are the lovers, and the Swiss organise everything.

That's Heaven.

Hell is where the British are the cooks, the French are the engineers, the Germans are the policemen, the Swiss are the lovers and the Italians organise everything.

OK, I know it didn't have anything to do with computers. Let's hear yours.

Free computer

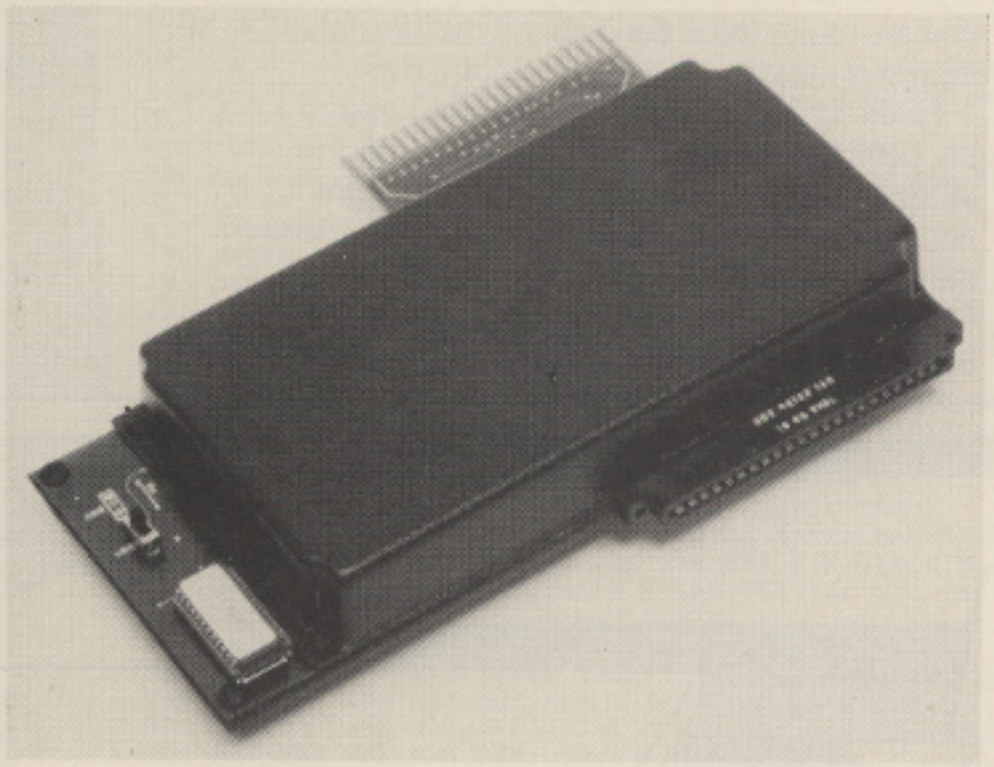
It is not so long since I was offered free insurance if I bought a particularly nasty brand of computer.

Now they are giving computers away free with insurance. Or at least an outfit called Financial Planning is.

Take out a Norwich Union life policy with a monthly premium of £25, and F.P. will present you with a VIC-20 – gratis.

They will probably insure it for you too. Tel. Wentworth 2052 for the full S.P.

Make VIC butch



This sinister leather-look device turns the VIC-20 into a 32K computer. So what, you might think. Memory expansion boards have, after all, been around for some time.

Stack's *Storeboard* is rather more than that. It lets you add memory as you can afford it. Plug in a row of four chips and presto! You have another 8K of RAM. Stack are currently quoting £29 for 8K, which is a lot less than the last lot I bought, and could well fall further.

The *Storeboard* also has a socket that accepts games ROMs or any of the VICKIT series of ROMs that offer graphics commands and programming aids. If you already own a memory expansion cartridge, you can plug that into the expansion port at the back.

The *Storeboard* with 3K (high resolution graphics) RAM already fitted costs £49 + VAT from VIC dealers.

Clever people, Stack, but I am not too sure about their taste for black leather.

Keen on Corvus

Since about 95% of business correspondence is written on A4 paper with the short ends horizontal, you would have thought most computers would have adopted a similar form for their screen displays.

But no, the CRT is almost invariably positioned long sides horizontal, like a domestic television. Even in the market for dedicated word processors the vertical format is an exception.

In this and many other respects, Corvus have chosen to ignore conventional wisdom and go their own route. The TV screen can be turned either horizontally or vertically.

Take the question of processor, for example. Whilst almost everyone else is busy jumping on the 16-bit band wagon set rolling by IBM and Sirius, Corvus say they have opted for a 32-bit processor. But have they? We understand that the processor is the Motorola 68000, which I would call a true 16-bit chip. Floppy disks, now considered standard, receive similarly short shrift and are dispensed with altogether, in favour of 6, 10 or 20 megabyte hard disks (Corvus' history as a supplier of hard disks for Apple may have something to do with this decision).

Keen Computers, one of the original Apple distributors in this country, are handling the ***Concept*** *here. Dr. Tim Keen thinks sales will initially be to companies wanting a stand-alone desktop*

computer. The design however allows it to be upgraded to a full Omninet local area network (see January issue for the State-of-the-Art report on Networking). Up to 63 ***Concepts*** *can be networked to disk servers of up to 80 megabytes each, and a variety of peripherals.*

Software details are a little sketchy at present, although Pascal and FORTRAN compilers and a CP/M emulator are all being mentioned.

Probable price – £3500 to £4000 for the basic system, which includes 256K of RAM. The 6 megabyte hard disk will cost another £2400 or so. Keen say the ***Concept*** *will be available in July. Details from them at 5 Giltspur Street, London E.C.1. Tel: 01-236 5682.*

Typing Tutor

By Bob Chappell

A useful program that will improve your typing speed and keyboard accuracy.

If you're like me and only type with two fingers, then this program could help to turn you into a high-speed touch typist! It is a simplified set of typing exercises chosen to help you develop your dexterity on the keyboard.

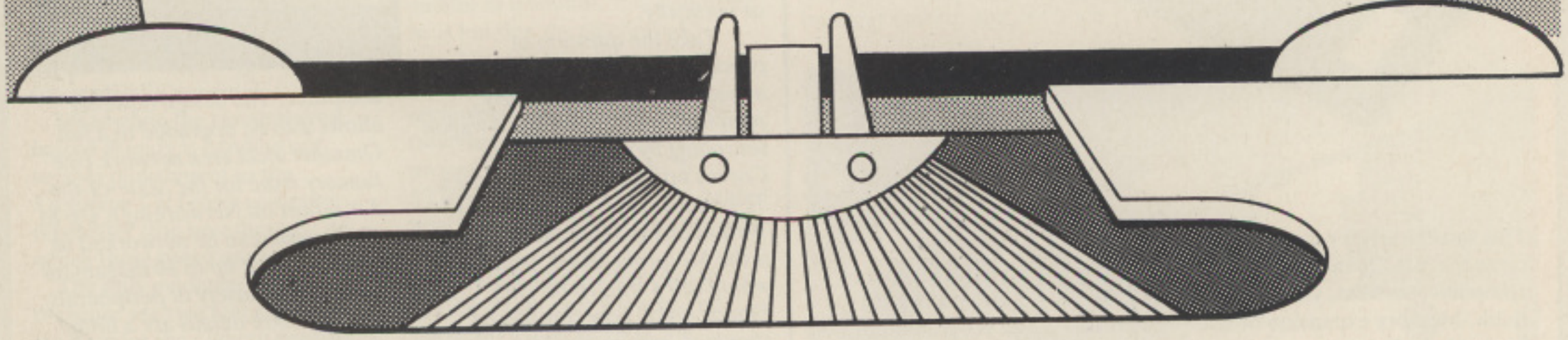
The program commences by asking you whether you'd like timings given after each portion of an exercise (there are ten exercises, each consisting of several parts) or after completing one whole exercise. You may then select from any of the ten exercises, although they are best worked through in order. Having selected an exercise, you will be shown which keys the exercise is centred on and which figures operate which keys.

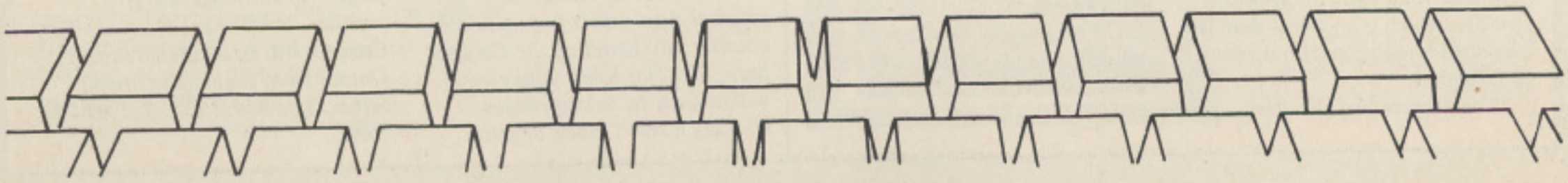
Each portion consists of displaying text on the screen and waiting for the typist to enter it exactly as shown. Wrongly typed letters are not displayed but a record is kept of the number of mistakes. A record of the time taken to complete the text is also kept. If so selected, an approximation of your typing speed, together with the total of mistakes made, is displayed at this point.

On completion of an exercise (following display of speed and total mistakes if selected for this point), you can elect to go on to the next exercise, repeat the same exercise or select any exercise.

The program only covers practice on letters and space since the majority of microcomputer keyboards have the normal QWERTY layout but vary in their positioning of numbers and punctuation marks. The user can easily adapt the program to include this facility. Each block of DATA statements covers one exercise. The first four lines in each of the blocks are the exercise number, the letters being practiced, the "finger codes", and the number of portions in the exercise. The "finger codes" are a numeric representation of which fingers type which keys; the left hand fingers are coded 1-4, going from the index finger to the little finger, whilst the right hand is coded from 5-8, again going from the index to the little finger. Thus a code of 4357 would represent the little and third fingers of the left hand, and the index and third fingers of the right hand. These codes correspond in order with the letters being practiced, e.g. EDFGHJ and 221155 indicates that E and D are covered by the middle finger of the left hand, F and G by the index finger of the left hand, and H and J by the index finger of the right hand. The thumbs are not coded but you are reminded in the displays that the right thumb is used to operate the Space Bar.

Lines 110-150 cause the selected text to be centralised, as near as possible, on the screen and were designed for a 40 column screen. If your screen is a different size, merely substitute a lower or higher number for 30, depending on whether you have a narrower or wider screen. The program uses a





PROGRAM LISTING

```
10 REM **TYPING PRACTICE**
20 REM **BOB CHAPPELL**4/4/82
30 GOTO1690
40 REM **FIND EXERCISE**
50 IFS=1GOTO70
60 FORJ=1TOS-1:READEX,FL$,FP$,N:FORJ1=1TON:READE$:NEXTJ1,J
70 GOSUB1480
80 REM **PRINT EXERCISE**
90 TS=0:TT=0:TL=0:FORJ=1TON:PRINTT$:PRINTU$:PRINT:PRINT:PRINT:PRINT
100 REM **CENTRALISE TEXT ON SCREEN**
110 READA$:L=LEN(A$):FORK=(30-L)/2TO1STEP-1:IFK<1THEN130
120 PRINT" ";:NEXTK
130 PRINTA$:PRINT:PRINT
140 FORK=(30-L)/2TO1STEP-1:IFK<1THEN160
150 PRINT" ";:NEXTK
160 SC=0:BT=TI:FORJ1=1TOL
170 GETB$:IFB$=""GOTO170
180 IFB$<>MID$(A$,J1,1)THENL=L+1:SC=SC+1:GOTO170
190 PRINTB$;:NEXTJ1:FT=TI-BT:TT=TT+FT:TL=TL+L:TS=TS+SC:IFSP=2GOTO280
200 PRINT:PRINT:PRINT
210 PRINT"     YOU MADE";:IFSC=0THENPRINT" NO MISTAKES.":GOTO240
220 IFSC=1THENPRINT" 1 MISTAKE.":GOTO240
230 PRINTSC;"MISTAKES."
240 PRINT:PRINT:PRINT"  YOUR TYPING SPEED IS APPROX"
250 PRINT:X=INT((L/(FT/60)*60)/5))IFX<1THENPRINT"   1 WORD";:GOTO270
260 PRINT"   ";X;"WORDS";
270 PRINT" PER MINUTE.":GOSUB1650
280 NEXTJ
290 IFSP=1GOTO390
300 PRINT:PRINT:PRINT
310 PRINT"     YOU MADE";:IFTS=0THENPRINT" NO MISTAKES.":GOTO340
320 IFTS=1THENPRINT" 1 MISTAKE.":GOTO340
330 PRINTTS;"MISTAKES."
340 PRINT:PRINT:PRINT"  YOUR TYPING SPEED IS APPROX"
350 PRINT:X=INT((TL/(TT/60)*60)/5):IFX<1THENPRINT"   1 WORD";:GOTO370
360 PRINT"   ";X;"WORDS";
370 PRINT" PER MINUTE.":GOSUB1650
380 REM **NEXT EXERCISE**
390 RESTORE:PRINTT$:PRINTU$:PRINT:PRINT
400 PRINT"TYPE:-"
410 IFS<10THENPRINT:PRINT"      SPACE FOR NEXT EXERCISE"
420 PRINT:PRINT"      S TO SELECT AN EXERCISE"
430 PRINT:PRINT"      R TO REPEAT THE LAST EXERCISE":PRINT
440 GETA$:IFA$=""GOTO440
450 IFA$=" "ANDS<10THENS=S+1:GOTO50
460 IFA$="S"GOTO1750
470 IFA$="R"GOTO50
480 GOTO440
490 REM **EXERCISES**
500 DATA1,ASDFJKL,4321567,23,ASDF,LKJASDF,LKJASDF,LKJASDF,LKJ
510 DATAFDSAJKL,FDSAJKL,FDSAJKL,FDSAJKL,FDSAJKL
520 DATAASDF,LKJ ASDF,LKJ ASDF,LKJ ASDF,LKJ
530 DATAFDSA JKL,FDSA JKL,FDSA JKL,FDSA JKL
540 DATASAD DAD LAD ALL,ADD ASK ASS AS
550 DATAASKS ALAS FALL DADS,FLAK LASS LADS ADD
560 DATA2,EDFGHJ,221155,22,ASDFGFD,LKJHJK ASDFGFD,LKJHJK ASDFGFD,LKJHJK
570 DATAFGF JHJ AGF,HJ FGF JHJ AGF,HJ FGF JHJ AGF HJ
580 DATAHAG FAG JAG SAG,LAG HAS GAS ASH
590 DATAGLAD SHAG FLAG LASH,SASH HALL HALF HAG
600 DATADED,ED LED KED,JED HED DED,ED LED KED JED HED
610 DATAE D ELD EKD,EJD EHD EAD E,D ELD EKD EJD EHD EAD
620 DATAFED LED KEG LEG,ELF ELK SHE HE
630 DATASEED HEED FEED SHED,FLED HEAD LEAD HELD
640 DATA3,RTF,111,24,FRF RF LRF,KRF JRF HRF FRF,RF LRF KRF JRF HRF
650 DATAR F RLF RKF,RJF RHF RAF R,F RLF RKF RJF RHF RAF
660 DATARED RAG ARK ARE,FAR JAR HER EAR
670 DATARASH REEL REAL HEAR,HARK HARE HERE JEER
680 DATARAGED RAKED HEARD LARKS,LARGE LAGER SAFER ELDER
690 DATAFTF TF LTF,KTF JTF HTF FTF,TF LTF KTF JTF HTF
700 DATAT F TLF TKF,TJF THF TAF T,F TLF TKF TJF THF TAF
710 DATATAG TAR THE JET,LET FAT HAT AT
720 DATATHAT TALL TALK TREK,HATE LATE JEST LAST
730 DATATELLS THEFT THERE THREE,FATAL LATER HALTS LEAST
740 DATA4,UJIK,5566,24,KIK AIK SIK DIK,FIK GIK KIK AIK,SIK DIK FIK GIK
750 DATAIAK ISK IDK IFK,IGK I K IAK ISK,IDK IFK IGK I K
760 DATASIR FIR FIT JIG,AID DID HID IS
770 DATAGIFT SIFT HILL FILL,GRID GRIT SAIL FAIL
780 DATASKILL STILL RIGHT TIGHT,DRIFT STIFF SILKS JILTS
790 DATAJUJ AUJ SUJ DUJ,FUJ GUJ JUJ AUJ,SUJ DUJ FUJ GUJ
800 DATAUAJ USJ UDJ UFJ,UGJ U J UAJ USJ,UDJ UFJ UGJ U J
810 DATAUSE DUG RUG SUE,DUE HUT RUT FUR
820 DATASURE TURF HURT JUST,RUSH TRUE RULE DULL
830 DATAUTTER USHER USUAL SUGAR,RURAL TRUTH TRUST FRUIT
840 DATA5,DCYJ,2255,24,JYJ AYJ SYJ DYJ,FYJ GYJ JYJ AYJ,SYJ DYJ FYJ GYJ
850 DATAYAJ YSJ YDJ YFJ,YGJ Y J YAJ YSJ,YDJ YFJ YGJ Y J
860 DATAYES YET SAY DAY,TRY FRY SLY FLY
870 DATAYEAR YELL YARD GREY,THEY TRAY LADY JURY
880 DATAYEAST HURRY DIARY SADLY,SILKY FIFTY STUDY STYLE
890 DATADCD CD LCD KCD,JCD HCD DCD CD,LCD KCD JCD HCD
900 DATAC D CLD CKD CJD,CHD CAD C D CLD,CKD CJD CHD CAD
910 DATACAD CAR CAT CUT,CUR ACT ICE ICY
920 DATACITY CALL CAKE CURE,SCAR DUCK KICK SACK
930 DATACHEER CIGAR CRATE CRACK,TRUCK THICK TRACE TRUCE
940 DATA6,FVB,111,24,FVF VF LVF KVF,JVF HVF FVF VF,LVF KVF JVF HVF
950 DATAV F VLF VKF VJF,VHF VAF V F VLF,VKF VJF VHF VAF
960 DATAVAT VAS VIS VIA,VIE VET REV DIV
970 DATAVALE VASE VARY VERY,CAVE HAVE LIVE FIVE
980 DATAVAGUE VALVE VALID VIVID,VERVE CURVE CARVE EVERY
990 DATAFBF BF LBF,KBF JBF HBF FBF,BF LBF KBF JBF HBF
1000 DATAB F BLF BKF BJF,BHF BAF B F BLF,BKF BJF BHF BAF
1010 DATABAG BAT BUT BUY,TAB CAB CUB TUB
1020 DATABALL BACK BULK ABLE,STUB STAB GLIB GIBE
```

continued

standard form of BASIC and should run with minimum changes on most micros. The only usual feature is the clear screen symbol in line 1690. The REM (remarks) statements show what each section of the program is doing – they may be omitted. The program runs in under 8k. The graphic representation of the keyboard in lines 1820-1890 may be omitted if your micro does not have the appropriate graphics characters – the representation is for clarity only and can be dispensed with.

Happy key hammering!

Major Variables used in the Program

T$ and U$	Title
FP$( )	Text for finger positions
SP	Indicates at which point speed rating is displayed.
S	Selected exercise
EX	Exercise number
FL$	Letters covered in this exercise
FP$	Finger position codes
N	Number of portions in this exercise
SC	Scored mistakes this portion
TS	Total mistakes this exercise
BT	Time started this portion
FT	Time finished this portion
TT	Total time taken for this exercise
TI	Time elapsed in "Jiffies" (seconds x 60) since the computer was switched on. If your micro has not got a facility of this nature, you can simulate it roughly by building up a count and equating that with the number of seconds that have elapsed.

```
1030 DATABURST BRICK ABBEY ABUSE,CABLE TABLE TRIBE LABEL
1040 DATA7,JNMK,5556,35,K K A K S K,D K F K G K,K K A K S K,D K F K G K
1050 DATAKA KS KD KF,KG KJ KA KS,KD KF KG KJ
1060 DATAUS AT IF BE,IS AS IT HE,HIT BID BUT LAY,DUG FIG HIS HER
1070 DATAJMJ AMJ SMJ DMJ,FMJ GMJ JMJ AMJ,SMJ DMJ FMJ GMJ
1080 DATAMAJ MSJ MDJ MFJ,MGJ M J MAJ MSJ,MDJ MFJ MGJ M J
1090 DATAMAT MAY MUD MUG,AIM RIM SUM HUM
1100 DATAMAKE MARE MISS MILK,DUMB LAMBB HEM TRAM
1110 DATAMIGHT MERIT MARCH MADAM,SHAME BLAME FRAME GRIME
1120 DATAJNJ ANJ SNJ DNJ,FNJ GNJ JNJ ANJ,SNJ DNJ FNJ GNJ
1130 DATANAJ NSJ NDJ NFJ,NGJ N J NAJ NSJ,NDJ NFJ NGJ N J
1140 DATANET NUT NAG NIB,ANY INK FEN HEN
1150 DATANEAT NECK NICK LINK,BANK GRIN THIN THAN
1160 DATANURSE NEVER KNIFE THING,BLEND TREND TRAIN GRAIN
1170 DATA8,WSX,333,24,SWS WS LWS KWS,JWS HWS SWS WS,LWS KWS JWS HWS
1180 DATAW S WLS WKS WJS,WHS WAS W S WLS,WKS WJS WHS WAS
1190 DATAWAS WAY WIN WIG,RAW SAW FEW NEW
1200 DATAWILL WITH WHEN WHAT,STEW DREW DRAW FLAW
1210 DATAWASTE WATER WHITE WHIRL,STRAW THREW SCREW RENEW
1220 DATASXS XS LXS KXS,JXS HXS SXS XS,LXS KXS JXS HXS
1230 DATAX S XLS XKS XJS,XHS XAS X S XLS,XKS XJS XHS XAS
1240 DATASIX FIX MIX TAX,LAX WAX SEX VEX
1250 DATAAXLE AXIS EXIT TEXT,FLEX FLAX FLUX CRUX
1260 DATAEXTRA EXACT EXCEL EXERT,EXILE EXIST INDEX SIXTY
1270 DATA9,QAZ,444,20,AQA QA LQA KQA,JQA HQA AQA QA,LQA KQA JQA HQA
1280 DATAQ A QLA QKA QJA,QHA QHA Q A QLA,QKA QJA QHA QHA
1290 DATAQUIT QUID QUIN QUEY,QUAY QUAD QUAG AQUA
1300 DATAQUACK QUART QUEER QUEEN,QUEST QUIRE QUILT QUILL
1310 DATAAZA ZA LZA KZA,JZA HZA AZA ZA,LZA KZA JZA HZA
1320 DATAZ A ZLA ZKA ZJA,ZHA ZFA Z A ZLA,ZKA ZJA ZHA ZFA
1330 DATAZEAL ZEST ZINC HAZE,MAZE LAZY FIZZ JAZZ
1340 DATAZEBRA AZURE HAZEL DAZED,BLAZE SIZES DIZZY BAIZE
1350 DATA10,OLP,778,28,LOL AOL SOL DOL,FOL GOL LOL AOL,SOL DOL FOL GOL
1360 DATAOAL OSL ODL OFL,OGL O L OAL OSL,ODL OFL OGL O L
1370 DATAONE OWE ODD OFF,WON LOG NOT TOE
1380 DATAONLY ONCE OMIT OOZE,COME COVE LOSE CROW
1390 DATAOTHER OFFER OFTEN OCCUR,JOLLY WRONG FROCK FLOOD
1400 DATAL L A L S L D L,F L G L L L A L,S L D L F L G L
1410 DATAAL SL D AL,GL L AL SL,DL FL GL L
1420 DATAP AP SP DP FP GP,P AP SP DP FP GP
1430 DATAPA PS PD PF,PG PJ PA PS,PD PF PG PJ
1440 DATAPEN PEA PIT PIP,LAP TAP TIP SIP
1450 DATAPAGE PAID PECK PEEP,DRIP CLIP HARP CARP
1460 DATAPEARL PENNY PERCH PILOT,STOOP PROPS DRAPE APTLY
1470 REM **PRINT FINGER POSITIONS**
1480 READEX,FL$,FP$,N:PRINTT$:PRINTU$
1490 PRINT:PRINTTAB(12)"EXERCISE";EX
1500 PRINTTAB(10)"--------------"
1510 LF=0:RF=0:FORJ=1TOLEN(FP$)
1520 A$=MID$(FL$,J,1):J1=VAL(MID$(FP$,J,1))
1530 IFJ1>4ANDRF=0GOTO1590
1540 IFJ1>4GOTO1610
1550 IFLF=1GOTO1580
1560 PRINT"h":PRINT:PRINT:PRINT:PRINT:PRINT"     LEFT HAND":LF=1
1570 PRINT"     ---------"
1580 PRINT:PRINTA$;FP$(J1):GOTO1620
1590 PRINT"h":PRINT:PRINT:PRINT:PRINT:PRINT:PRINTTAB(24)"RIGHT HAND":RF=1
1600 PRINTTAB(24)"----------"
1610 PRINT:PRINTTAB(20);A$;FP$(J1)
1620 NEXTJ
1630 PRINT"h":FORJ=1TO16:PRINT:NEXTJ:PRINT"   RIGHT HAND THUMB FOR SPACE BAR"
1640 REM **PAUSE ROUTINE**
1650 PRINT:PRINT:PRINT:PRINT:PRINT:PRINT"     PRESS SPACE TO CONTINUE"
1660 GETA$:IFA$<>" "THEN1660
1670 RETURN
1680 REM **INITIALISE**
1690 T$="c        TYPING PRACTICE"
1700 U$="        ================"
1710 DIMFP$(8):FP$(1)="  FIRST FINGER":FP$(5)=FP$(1)
1720 FP$(2)="  SECOND FINGER":FP$(6)=FP$(2)
1730 FP$(3)="  THIRD FINGER":FP$(7)=FP$(3)
1740 FP$(4)="  LITTLE FINGER":FP$(8)=FP$(4)
1750 RESTORE:PRINTT$:PRINTU$:PRINT
1760 PRINT"TYPING SPEED TO BE GIVEN:-
1770 PRINT:PRINT"1. AFTER EACH PART OF AN EXERCISE
1780 PRINT:PRINT"2. AFTER EACH EXERCISE
1790 PRINT:PRINT:INPUT"WHICH NUMBER";A$
1800 SP=VAL(A$):IFSP<1ORSP>2GOTO1790
1810 PRINTT$:PRINTU$:PRINT
1820 PRINT"                                    ":REM USE GRAPHICS HERE
1830 PRINT"     }Q}W}E}R}T}Y}U}I}O}P}     ":REM TO SHOW KEYBOARD LAYOUT
1840 PRINT"
1850 PRINT"      }A}S}D}F}G}H}J}K}L}
1860 PRINT"
1870 PRINT"       }Z}X}C}V}B}N}M}
1880 PRINT"
1890 PRINT"
1900 PRINT:PRINT"THE EXERCISES ARE NUMBERED FROM
1910 PRINT:PRINTTAB(12);"1 TO 10."
1920 PRINT:INPUT"WHICH ONE DO YOU WANT TO START AT";A$
1930 S=VAL(A$):IFS<1ORS>10GOTO1920
1940 GOTO50
          c=cLEAR sCREEN   h=cURSOR hOME
```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DREAM &

Terry Hope dreams a Tolkien-like tale and wakes up to find hi

J. R. Tolkien fans (believe me, I'm one – which might explain the curiosity of what follows) will have to forgive my arrogance in dozing off the other evening and dreaming I was none other than the master himself.

Everything was a little hazy, but I was certainly poised, pen in hand, over a clean sheet of paper. Then, as I watched from somewhere outside myself, I slowly began to write...

I know of a group known as Skaerf Retupmoc who live in a country which is (or rather, was) green and pleasant but just the tiniest bit dull. Until but (for this is how they measure their time) a few sraey ago, life stretched out monotonously for the Skaerf Retupmoc.

Interestingly, the Skaerf Retupmoc are not numerous compared with all in the land. But it is said (by themselves admittedly) that they are visionaries, seeing ten to twenty sraey hence.

In that time, they say, nearly all will become Skaerf Retupmoc (or possibly Sresu Retupmoc, for it is only a question of degree), for the retupmoc (an artifact from which the skaerf get their name) will be in the dwellings of nearly all, resting alongside the sertnec cisum (another artifact which nearly all the people possess), and the pleasure level of life will increase thereby.

But I digress. One day, all was changed for the Skaerf Retupmoc when they heard of giants who made many and varied types of retupmoc and lived in countries across the sea. These countries were many leagues away, but still close enough for the seven league boots the giants wore to carry them easily across the water.

It was not long before some giants came and, though they mostly proved benevolent, they did have one or two rather unpleasant failings as far as the Retupmoc Skaerf were concerned. Indeed, they were more than a failing, they were the worst possible sins.

From one thing, the first giants did indeed produce many diverse and wondrous retupmoc, but the instruction tablets which accompanied them might as well have been written in a foreign tongue for all the skaerf could understand them. Worse, the giants promised goodies of various kinds, only to break their promises later. Perhaps most evil of all, the giants produced retupmoc only to replace them later with different retupmoc which bore no relation to the first ones.

Quite quickly the Skaerf Retupmoc became disillusioned. It seemed that few of the giants could be trusted. Thus it was, when rumours of yet another giant's arrival were whispered, together with tales of goodies the like of which had never been seen before, the Skaerf Retupmoc looked very disbelieving.

It seemed these new giants were brothers, and known collectively (for they were Siamese twins) as Sorb Renraw.

Sorb Renraw was (or perhaps it should be were) known to be benevolent too, and it seemed that he (or they) planned to send a new-born son named Irata to converse with the Skaerf Retupmoc, and even to make many new Skaerf Retupmoc of those who were still unknowing of the retupmoc magic. Irata was to stay with Sorb Renraw's good friend (or so it was said) Llosregni, and from Llosregni's castle to the north of Nodnol, Irata would venture forth and speak to the Skaerf Retupmoc in their thousands.

Alas for the Skaerf Retupmoc, it seemed after a period that this too was but a shallow deception. True, Irata did venture forth and conversed with over 6,500 of the people, some of whom were already Skaerf Retupmoc and many who were not. All of whatever sort, through accepting Irata's token (which came in two sizes and several variations), became known as Skaerf Retupmoc Irata.

But for the most part Irata made little impression on the non-skaerf and only slightly more on the Skaerf, which displeased Sorb Renraw a very great deal – indeed, some said he was hacked off, an odd phrase the Skaerf Retupmoc also used but in a different way.

Sorb Renraw began to look suspiciously across the water at Llosregni, for he had a growing feeling that Llosregni had insufficient interest in introducing Irata to enough people.

Llosregni protested innocence and, it was said, offered all manner of explanation, but none was good enough to satisfy Sorb Renraw.

Had not Irata already proved popular with many, many thousands of Sorb Renraw's own countrymen? Was not Irata totally unlike any other, with many more facets to his being than the average Skaerf Retupmoc would ever know? Did not Irata have beautiful tablets of instruction, which even the most nervous of non-skaerf could comprehend?

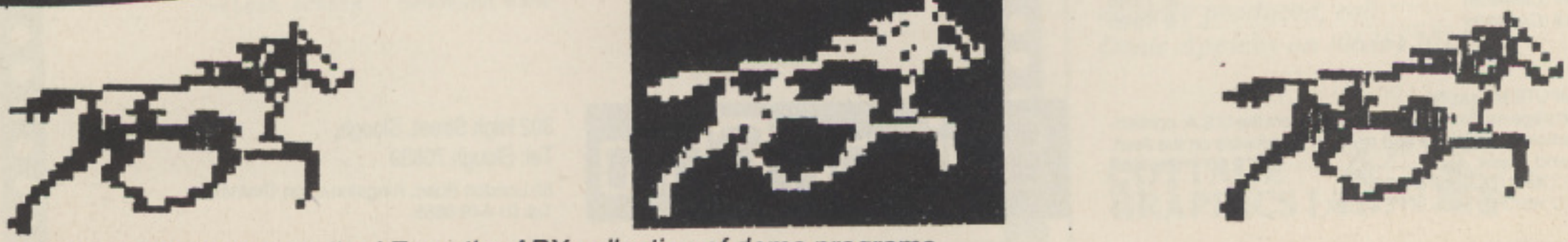
Perhaps, thought Sorb Renraw, Llosregni was not handling the arrangements as Sorb Renraw would have done, and no sooner had he thought it than he became convinced of the truth of the matter.

So it seemed there was only one thing to be done. He, Sorb Renraw himself no less, would cross the water and personally guide and control Irata's destiny. He would carry with him all the goodies that Llosregni seemed to have overlooked; he would smile and beam and show and tell; he would open his purse and spend many gold pieces (much more than Llosregni had seemed willing to disburse); and he would bring Irata to the masses.

And so Sorb Renraw arrived in person. It was a quiet, almost secret affair. There was no sounding of brass, but the differences became apparent almost immediately.

Llosregni, for instance, vanished almost without trace, save for great riches which it was said Sorb Renraw had passed into Llosregni's hands. Quite why these riches were passed none knew, since was not Irata the lawful son of Sorb Renraw (and much beloved for he earned great sums for Sorb Renraw in their home country). Perhaps, it was said, the riches were for the introductions which Llosregni had already performed, few though they were in Sorb Renraw's eyes.

Whatever the truth of the matter, Sorb Renraw moved into Llosregni's castle north of Nodnol, where he planned to live temporarily while an even more splendid abode was readied for him in Notrepla, which was more central ot Nodnol, not in the jungles to the



Horses which actually gallop! From the APX collection of demo programs.

& REALITY

Atari Software

nd himself testing Atari's program exchange software.

north, and thus true to Sorb Renraw's image.

And Irata? What became of him? Did he become known to many who were not as yet skaerf? Was his carefully designed raiment, his beautifully honed manners, his simplicity of speech and usage, his friendly approach, of great and lasting appeal to the non-skaerf?

Ah, my friends, this is where we must wait to see, for this is a fable which is not yet finished....

And then I woke up

Now you'll appreciate that all of the above was the merest frothy diversion; dreamt during a desultory doze, with no connection at all with Atari home computers. And yet there are, I suppose, certain parallels. Perhaps the most striking is what you and I are going to see over the months to come as Atari gets into its stride.

And to that extent, I've been having a very close look at something which is currently unique to Atari, the Atari Program Exchange, which is known as APX for short.

Actually, the name's a bit misleading, because at first sight it suggests there's some sort of swap element involved. You know the sort of thing: you send a good program in and you get a bad one back.

Not so in the case of APX, the concept and name of which is presumably derived from the PX of American Forces' bases. We call the same thing over here, from which you'll gather the PX is a sort of low-cost shop, run for the benefit of those qualified to take advantage of it. And that's exactly how the Atari Program Exchange works too.

How APX works

To explain the idea fully, let me quote from the Atari APX Catalogue:

"Atari created the APX to distribute user-written software for Atari home computers. The goal is to increase the usefulness of Atari computers by building a library of high-quality, imaginative software appealing to users of various ages and with differing needs and interests.

Atari offers this software quickly and inexpensively by using simple packaging, relying on user instructions written by the software author to APX standards, and foregoing follow-up support. In many cases the program author provides the follow-up support; the (catalogue) descriptions indicate when an author supports a program. The descriptions include both a program's strengths and its limitations, so you know what to expect."

Now there's no doubt at all that Atari's arrival in the UK as a distributor of their own products in their own right is a very important event indeed for anyone who's thinking of buying a computer, or changing their existing model for another.

The one remark that's often made about this or that micro is "but there doesn't seem to be much software for it." In many cases this is true and all too often it stays true for an inexcusably long time. It's frustrating and infuriating. It's also stupid because it's Catch 22 incarnate.

Software sells hardware

One axiom in the computer world – and it was never more true in the micro world – is "software sells hardware". There'll always be those hardy souls who buy when a machine first appears, but there'll be more who wait until it seems that there's an adequate amount of software to support it.

For some reason, the APX programs seemed never to be available until Atari themselves arrived to market their own product in the UK. Don't ask me why – I don't understand it.

Thus there were only the fully-packaged, relatively expensive, Atari-written programs available. They were (and are) good, very good indeed, but they weren't enough.

Programs galore!

Now the full range of APX programs is about to be available, and that's going to make a dramatic difference. (True, *some* APX programs were available before from independent "grey" importers but at what seemed like very inflated prices.)

But how good are the APX programs? We've seen so-called "program libraries" before, and the material in them has always been of, how shall I put it, not hugely professional quality.

Well, I've had the opportunity over the last few weeks of testing, examining, using and playing with a large number of the APX programs, and I have to say right now that, by and large, I've been very impressed.

There's no way I can review everything in the APX catalogue here (there are over 100 programs listed and described in the Spring 1982 edition), but let me mention a few.

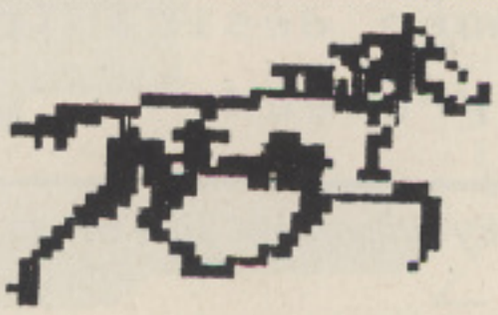
Six different categories

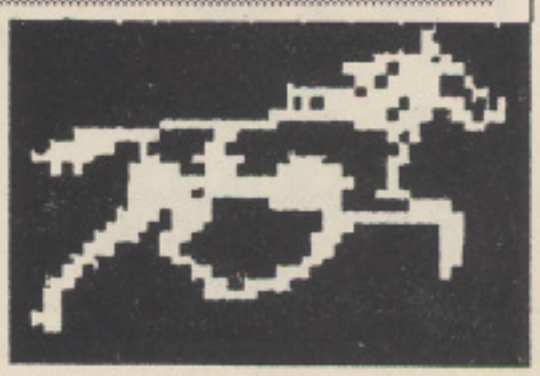
They come under six categories: "Personal Finance and Record Keeping", "Business and Professional Applications", "Personal Interest and Development", "Education", "Entertainment" and "System Software".

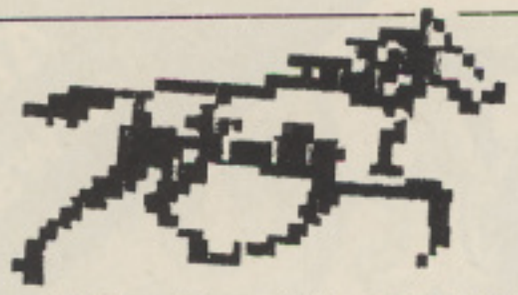
For purely personal reasons, the program I like the most is in the "System Software" category. It's a screen-to-printer dump utility.

The Centronics 739 printer (supplied by Atari's previous agents, Ingersoll, in place of

An orthographic equatorial map produced from the APX Mapware program, using the APX Screen Dump.







the Atari 825 printer which seems to have mysteriously disappeared from Atari's catalogue for the moment), is capable of high-resolution graphics printing.

Since the Atari computer is also capable of the same thing, it's marvellous to have a utility that allows *anything* on the screen to be dumped to the printer by simply pressing "control-P". The quality of the end-result is fairly evident from the reproductions with this article.

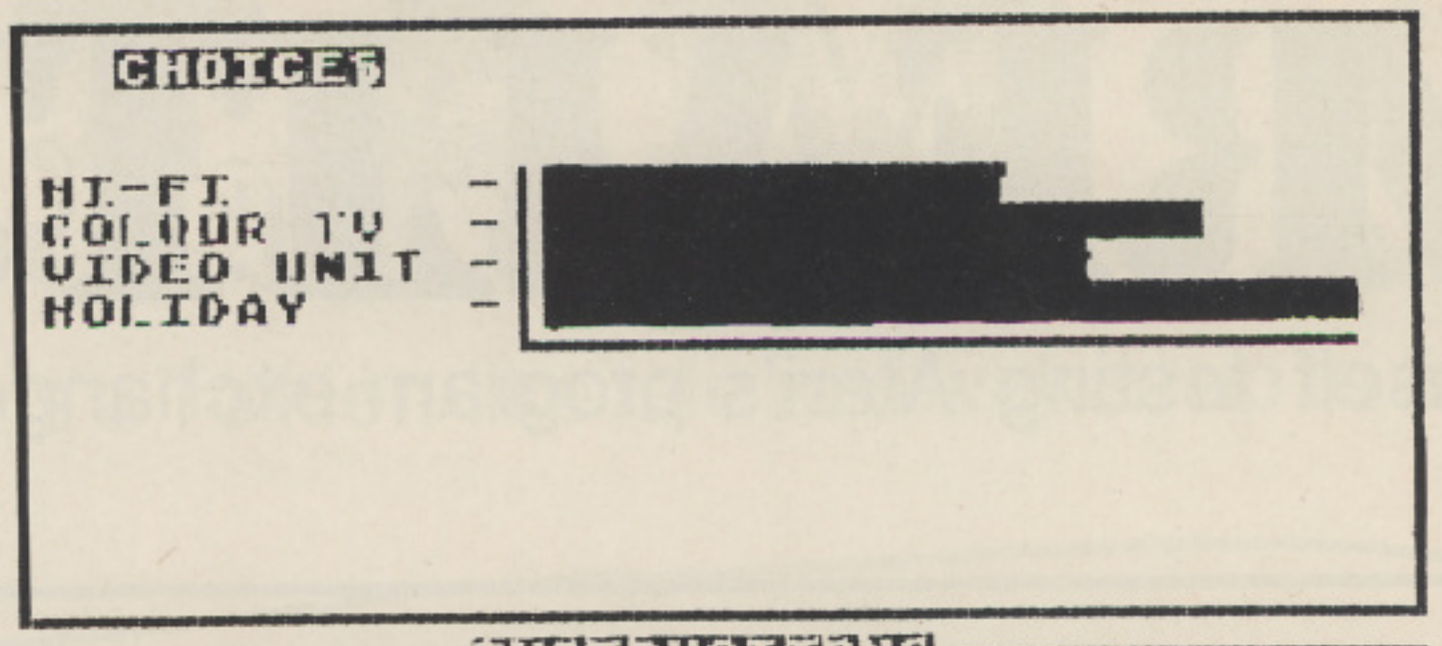
It boots itself into memory and stays there undisturbed until you power-down, so it can be thought of as an ever-present utility, to be activated whenever needed.

It's only available on disk and needs 24K of memory to run, but anyone with a printer is virtually certain to have a disk unit and enough memory. Price in the UK should be around £10.00 which gives you a good idea of the value you'll get from APX.

Entertainment's not forgotten

In the "Entertainment" category, let me mention two programs: Chris Crawford's eye-popping "Eastern Front" and William Graham's scarey "747 Landing Simulator". "Eastern Front" is a war-game which re-creates the German attack on Russia in 1941. The graphics are mind-blowing – there really is no other word for it. If you want to see the extraordinary effects Atari (and that's *your* Atari, if you have one) can produce, see "Eastern Front". It's available on cassette or disk for about £22.50, and runs in 16K for the former or 32K for the latter.

Bill Graham's "747 Landing Simulator" puts you fair and square in the pilot's set of a Jumbo, and invites you to see what the pilot sees while you (because you're the pilot) bring the plane in. It's immensely complicated; totally terrifying; and convinced me after I'd written off God knows how many aircraft that the RAF was right when they decided that flying wasn't for me. It's available on cassette or disk, will cost approximately £14.00, and you'll need 24K in either version to take to the skies.



The result of a full family decision – we'll go on holiday and no arguments!

Withdraw this program!

While on games, I'd like to bash out with a brickbat aimed fair and square at Alan Newman's "Domination". The APX catalogue bills it as "a game where greed, cunning and ruthlessness can work to your advantage." The catalogue also says it's "recommended for ages 12 and up". Leaving aside the question of whether it's a good thing to encourage 12-year-olds to be greedy, cunning and ruthless, the heart of the game involves competing for world power via economic means *and* (my italics) nuclear or conventional warfare.

I'm no wild-eyed pacifist, but neither am I terribly keen on the next generation growing up to believe greed, cunning, ruthlessness and nuclear weapons are the answer to the world's problems. It's all made worse by the thin disguises given to the names of the countries which figure in the game.

In my view, Atari should withdraw this game from the APX catalogue. I have few complaints about its programming, but I sure as hell feel strongly about the appalling insensitivity and bad taste demonstrated in its presentation and description. The fact that it earned first prize in last autumn's Atari-sponsored APX competition, and that the write-up on another program ("Letterman") says "has it ever bothered you that a game as fun as Hangman has a violent underlying premise?" makes it all the more obsene.

Make a map of anywhere!

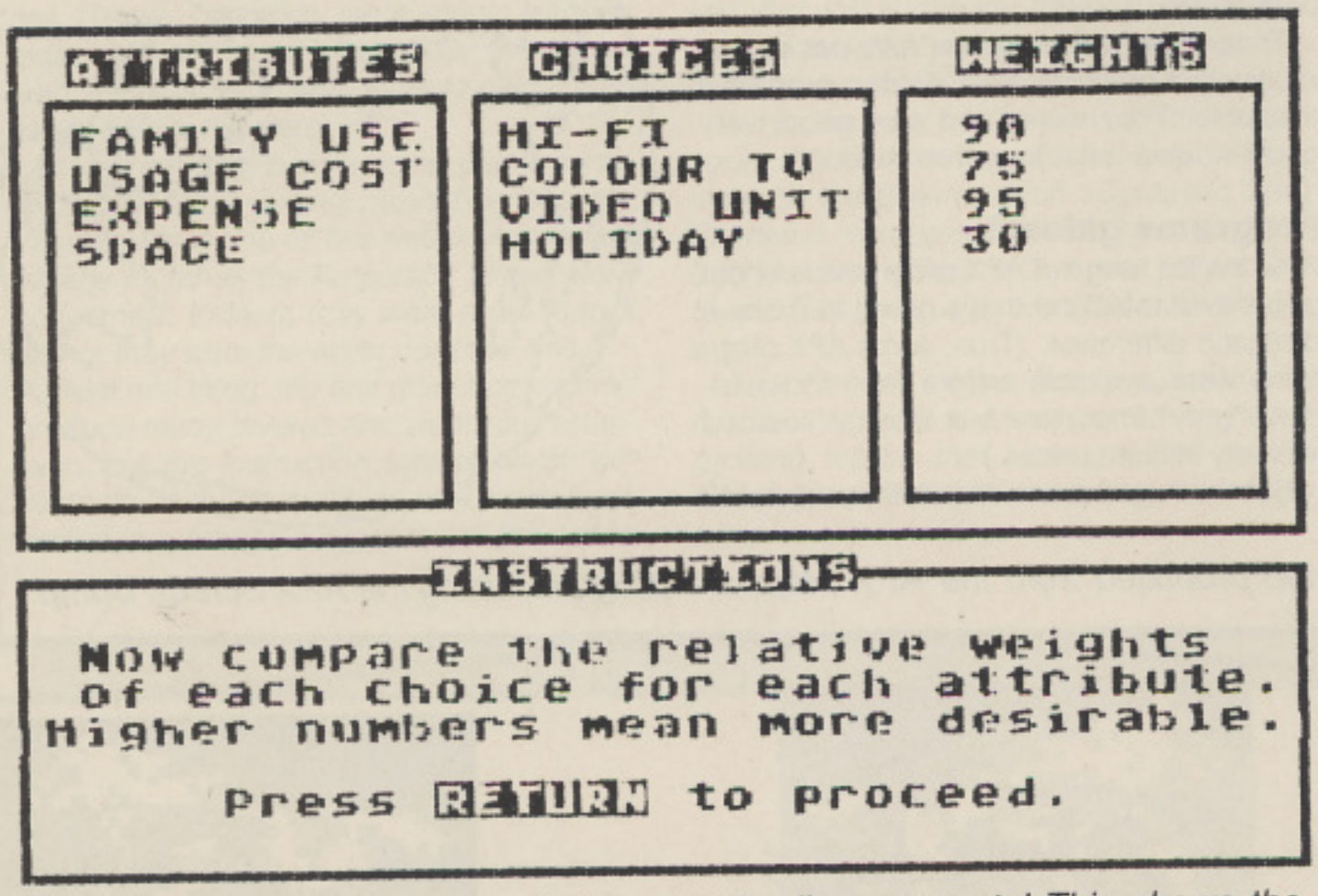
Now let's move on to two programs in the "Education" section: "Mapware" from Harry Koons and Art Prag, and the beautiful "My First Alphabet" from Fernando Herrera.

Messrs. Koons and Prag deserve an accolade supreme for a masterly bit of programming and efforts which must have taken them close to the edge of insanity.

"Mapware" comes on two disks (so of course you need a disk drive to use it), and will draw a map of *any* part of the world in *any* of four standard mapping projections – cylindrical, azimuthal equidistant, orthographic equatorial, or perspective.

All you need to input is the latitude and longitude of the place you're interested in and presto! the map is drawn in high-resolution.

It's all done with a clever program and 2,000 – yes, 2,000 – co-ordinates in data form on the second disk. The thought of entering that lot makes me blench. You'll need a disk drive to run it, of course, and a full 40K of RAM. I recommend it very highly, especially for teachers, and at about £17.00 for both disks, it's very, very good value for money.



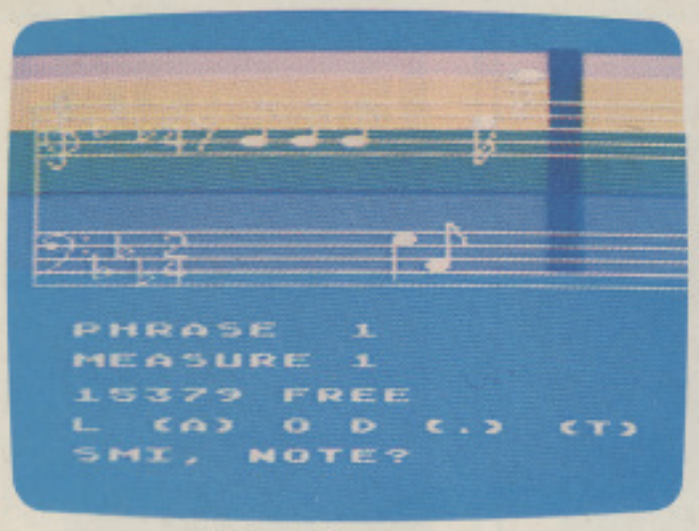
The APX Decision maker can help avoid family arguments! This shows the process half completed.

The $25,000 prizewinner

Which brings me to Fernando Herrera's "My First Alphabet". Every quarter, Atari give a prize for the best program submitted (this is in addition to the royalties program authors get from sales).

Then every year, Atari now give a grand prize of $25,000 for the best program of all. "My First Alphabet" took it last year and one viewing makes the reason why very clear.

Amazingly, Fernando Herrera first bought



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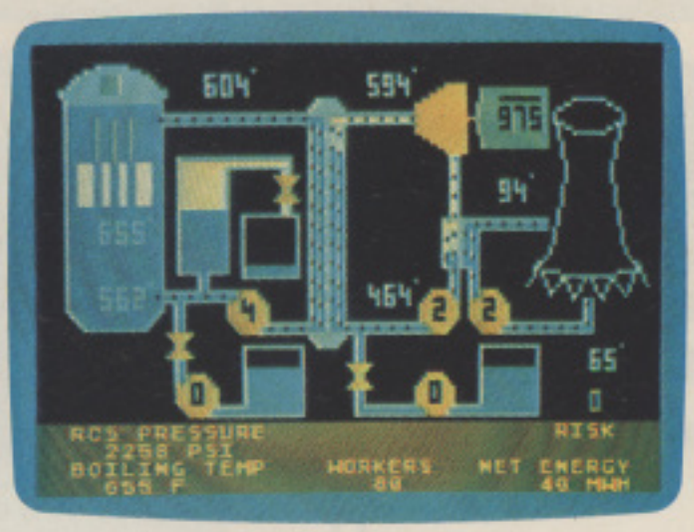
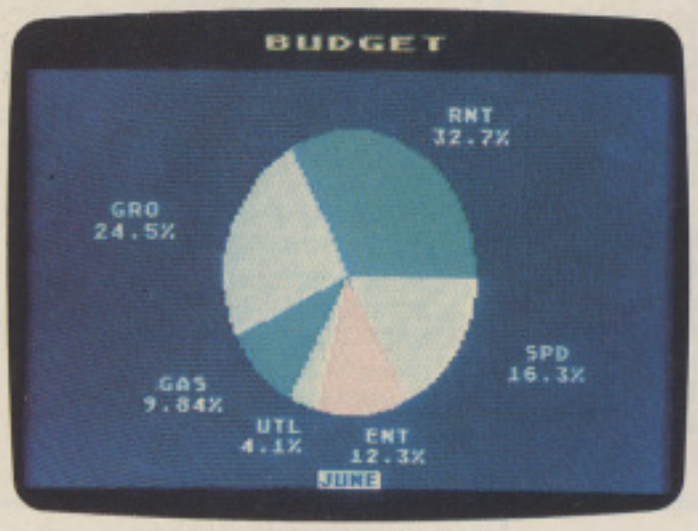
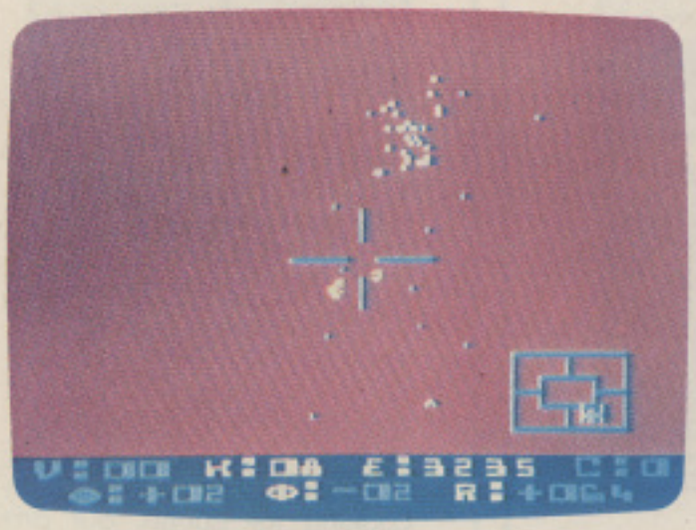


Scram



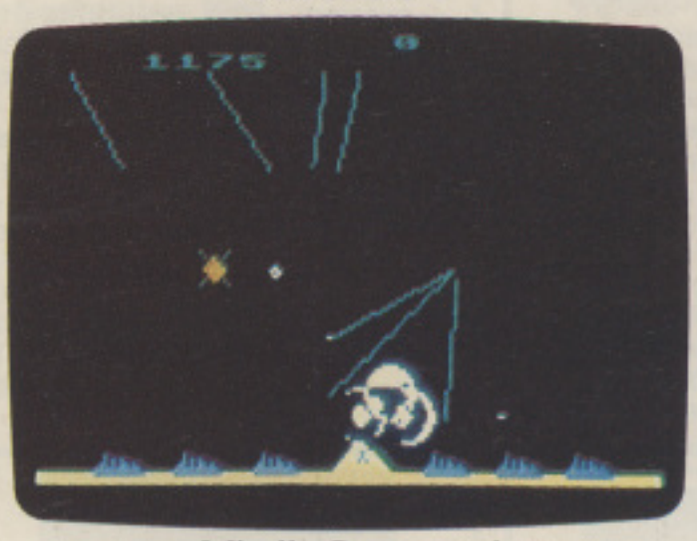
Graph-it

Intro to BASIC 1



Star Raiders

European Countries



Missile Command

Basketball

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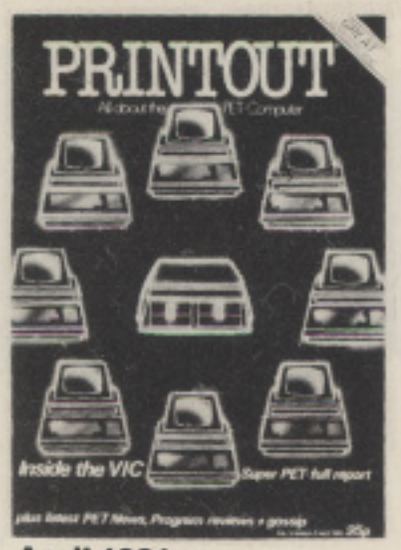

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HOW IT WORKS

Having looked at the 'black boxes' that make up the internals of a microcomputer, this month **Chris Preston** shrinks to microscopic size and explores the inside of a microprocessor.

In the last article in the current series, we will be actually delving inside the processor itself. This may seem a little extreme to readers who perhaps shudder at the thought of even peeking inside the lid of their computer, but it isn't as bad as all that. Obviously, we do not expect our readers to be designing their own processor chips; not even *MicroComputer Printout* could teach that in a single article! However, we do hope to remove some of the mystique surrounding that ultimate black box, the Central Processing Unit.

In last month's article, we looked at a simple block diagram of a computer, and we saw a box labelled "Processor", with three buses coming out of it, the Data Bus, the Address Bus, and the Control Bus. We know that when the processor is executing a program it is continually fetching instructions and data from memory, and maybe writing data back again. So what happens inside the processor, and how does it interpret its instructions?

Fig. 1 shows a block diagram of an imaginary processor. It is quite a simple unit, having only an accumulator, a stack pointer and program counter. A practical processor would possibly have several accumulators and some index registers.

Arithmetic Logic Unit

The work horse in the processor is of course the arithmetic and logic unit, usually called the ALU for short. This is where all the actual processing is done: addition, subtraction, shifting and so on. The ALU also contains a number of flags, (a flag is nothing more than a single bit which signifies the status of some operation), zero, sign, carry etc. which provide extra information on the results of calculations. In our little processor, all calculations are carried out either in memory or in the accumulator.

The address bus is controlled by the Next Address Register, NAR. This takes its value from either the Program Counter (PC), Stack Pointer (SP) or from the data bus. We will see exactly how it works a little later on.

The program is actually decoded and executed by the Instruction Decoder (ID), which fetches instructions from the program memory, decodes them and passes the necessary commands to the Control Unit (CU). This decoding is done under control of a microprogram. The instruction decoder is in effect a computer within a computer, with its own program! The main difference between the microprogram and the normal computer program is that whereas a program is sequential, each operation (A=15*B) having to wait until the previous operation is finished, a microprogram is parallel. For exam-

WORKS PART 3

ple, many instructions in a microcomputer occupy several bytes, so the instruction decoder can increment the program counter to fetch the next part of the instruction while at the same time the control unit is setting up the ALU to execute the instruction.

#15, which loads the number 15 into the accumulator.

Having fetched and decoded the opcode, the instruction decoder finds that it needs a byte of data, so it executes a 'memory read' cycle, moving the program counter to the next address register, then reading the value, 15, which is loaded

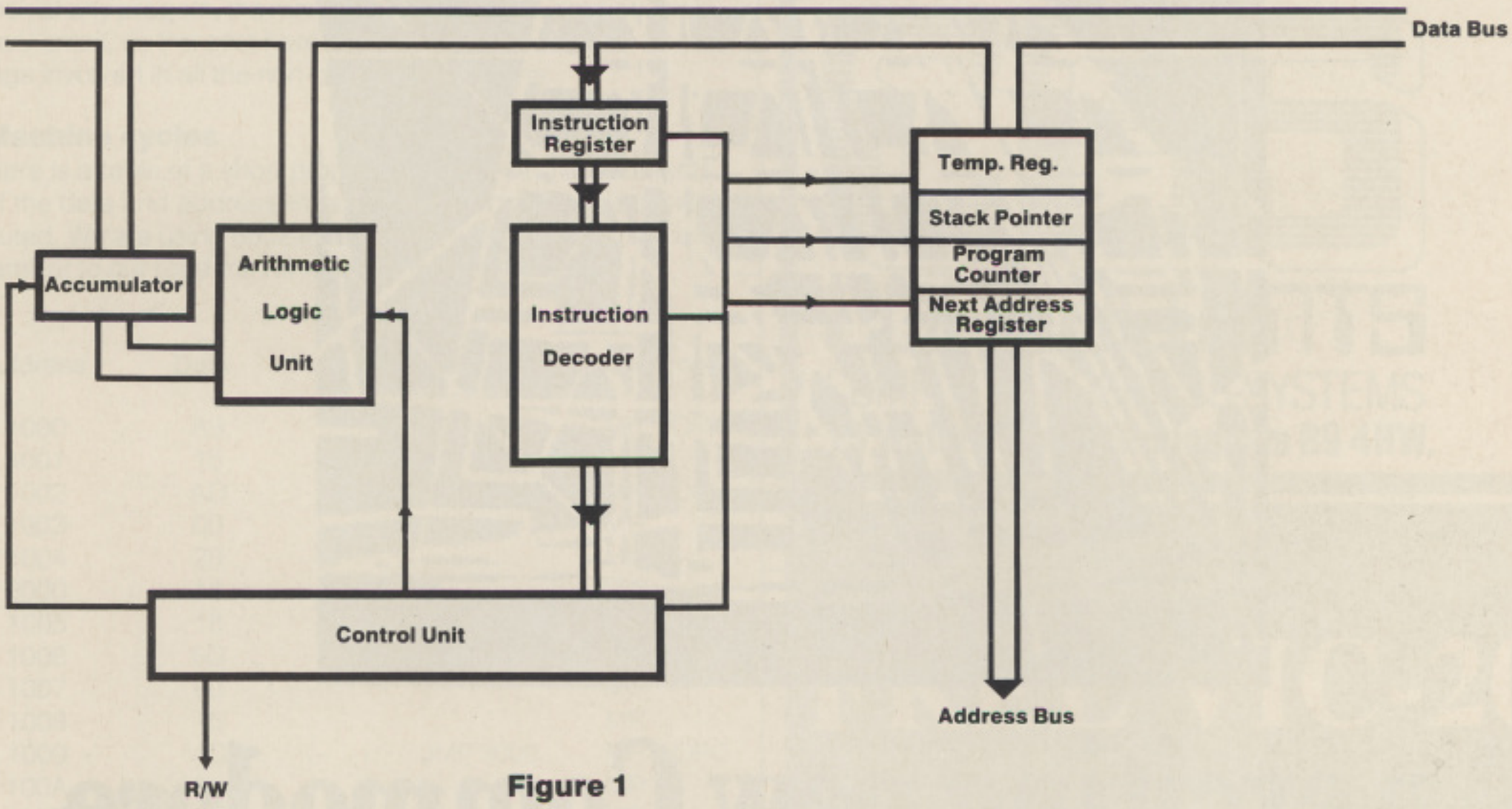


Figure 1

Instruction decoder

Before we look at some simple instructions, let us break down the process of executing an instruction. The first part is the instruction fetch, where the processor reads the opcode from memory and decides what to do with it. To do this, the instruction decoder moves the contents of the program counter into the next address register and sets the R/W line high, to tell memory that it wishes to read it. (If you do not understand this, go back to last month's article). It automatically increments the program counter to point to the next memory location.

At the same time it sets up the instruction register to read the opcode. When this arrives, it is held in the instruction register while it is being executed. This is called 'latching', and is necessary because the contents of the data bus will change during execution.

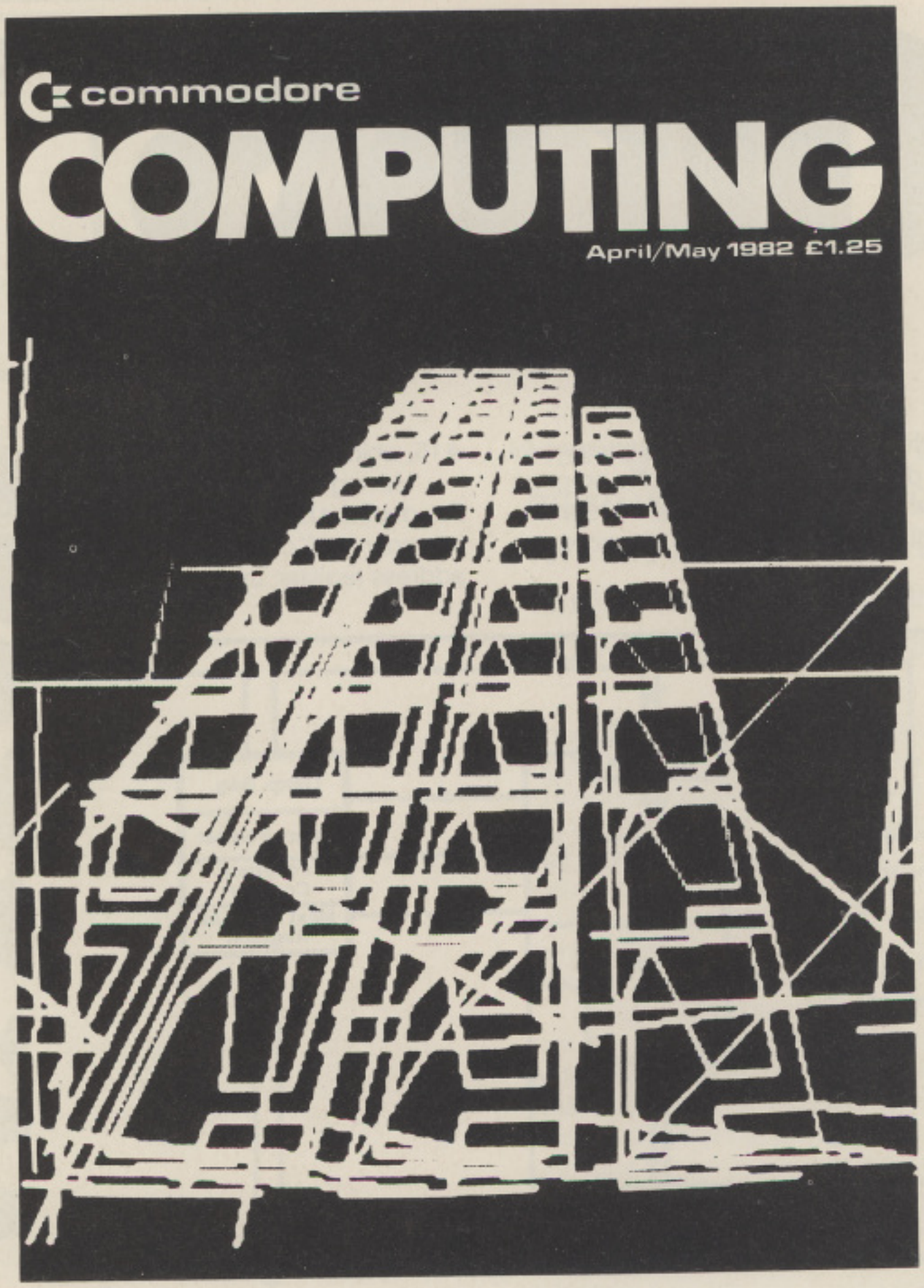
The instruction decoder then looks at the opcode and decides what to do next. The instruction may be a single byte instruction such as CLC, which clears the carry flag, in which case the instruction can be executed immediately, without having to read any more data from memory. Usually though, the instruction needs some data, in which case the program counter is moved to the next address register (and incremented automatically again) and the byte or bytes of data read. As an example of a two byte instruction we have LDA

into the accumulator. Again, the control unit performs several operations in parallel: setting up the address from the program counter and telling the accumulator to read the data bus.

Temporary register

In a program, the LDA #15 which sets a value in the accumulator, might well be followed by a STA 2000, which stores the contents of the accumulator in memory location 2000. How is this executed? After the instruction has been decoded, the decoder knows that it has to fetch an address, which occupies two bytes in a typical 8-bit micro, so it now has to execute two memory read cycles, one to fetch each byte. As each byte of this address is read from memory, it is stored in the temporary register. The next part of the instruction moves the contents of the temporary register, 2000, into the next address register and issues a write command, telling the accumulator to put its contents onto the data bus. This data is then accepted by the memory.

It is about time the ALU did some of the work round here, so let us look at ADD #5. This instruction adds 5 to the contents of the accumulator. After the decoder has decoded the opcode, it again passes the contents of the program counter to the next address register, incrementing the program counter at the same time, and reads the operand, 5. This data ▶



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HOW IT WORKS

is now loaded into the ALU, and the control unit tells the ALU to add it to the accumulator, and pass the results back to the accumulator.

The fact that the contents of the program counter are incremented automatically whenever its contents are read seems to be a good thing, but can you think of any occasions when this would waste time? When the processor executes a jump instruction, or a call to a subroutine, or in fact any instruction which causes a break in the normal program flow. This is because when the processor has finished decoding the instruction, and read all the operands, the program counter points to the next instruction after the jump instruction, but then the contents of the program counter are overwritten, which causes the jump to take place. However, if you look at any progam, the number of branch type instructions is very small, so the cost here is small compared with the savings involved in all the non-branch instructions.

Machine cycles

Here is a table of a short program run, showing the contents of the data and address lines as each machine cycle is executed. We are using 6502 mnemonics, which will be the most familiar to our readers. All values are in hexadecimal.

Address	Data	Assembly code	Machine code	
1000	A9	LDA #15	MR	OPC
1001	15		MR	
1002	AD	STA 2000	MR	OPC
1003	00		MR	
1004	20		MR	
2000	15		MW	
1005	18	CLC	MR	OPC
1006	6D	ADC 1500	MR	OPC
1007	00		MR	
1008	15		MR	
1009	4C	JMP 3000	MR	OPC
100A	00		MR	
100B	30		MR	
3000				

MR – Memory read
MW – Memory write
OPC – Opcode fetch

So we see that, even though our model was quite simple, we can use it to show most of the features found in the current range of 8-bit microprocessors, with the exception of indexed addressing modes. See if you can work out how a JSR and RTS combination would be executed. If you want to, you can add some index registers in between the temporary register and the stack pointer. In fact, most of the simplifications we have used in the model are 'practical' ones, rather than 'theoretical', that is we have left out multiplexers (a buzz word meaning switches) to isolate the various parts of the processor from each other and the outside world, and drivers, which allow the various internal registers to push their signals out to the rest of the computer without tiring themselves too much. These are not important when it comes to understanding how the thing works though, so why not leave them out.

This brings us to the end of our short series on computer hardware and architecture. If there are any other areas of computers on which you would like to see an article, why not put pen to paper and let us know about it?

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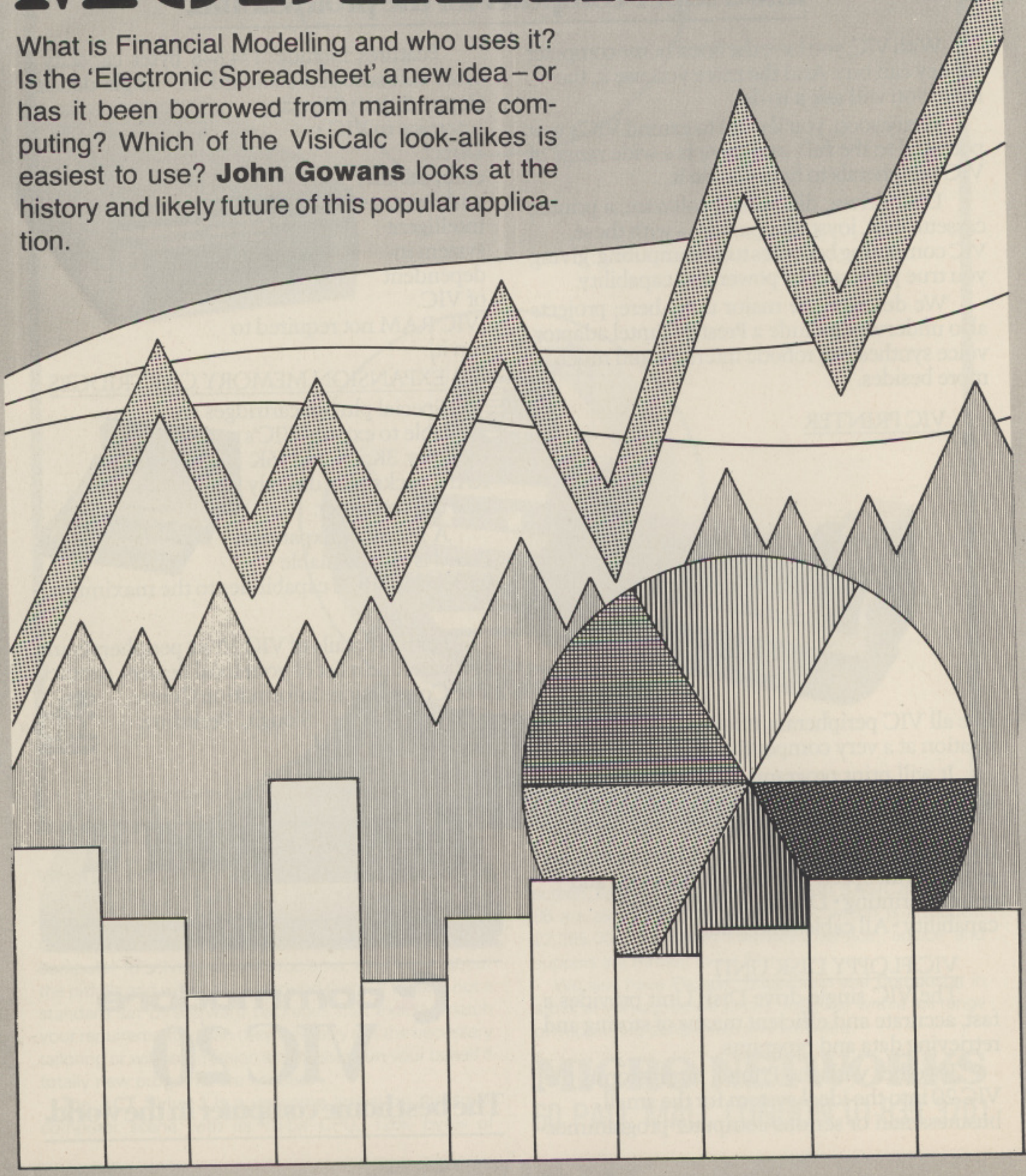
FINANCIAL MODELLING

What is Financial Modelling and who uses it? Is the 'Electronic Spreadsheet' a new idea – or has it been borrowed from mainframe computing? Which of the VisiCalc look-alikes is easiest to use? **John Gowans** looks at the history and likely future of this popular application.



State-of-the-Art Report :

"Be that bill our sign of parting, man or fiend!"
I shrieked, upstarting –
"Get thee back into the tempest and the Night's Plutonian shore!
Leave no VAT forms as a token of that lie they soul has spoken!
Leave my loneliness unbroken! – and quit the bust above my door!
Take they claws from out my wallet, and take thy form from off my door!"
Quoth the taxman, "Nevermore."

(With suitable apologies to a certain Mr E.A. Poe, and a reassurance to the editor that the copyright has run out – I hope.)

As the end of the tax year rolls inevitably round each spring, the average businessman's fancy lightly turns to thoughts of how the hell he is going to pay the bill – and of how to work out if tax changes in the Budget are going to have any effects on his business for the next 12 months. Those thoughts often run along E.A. Poe lines, and I have always thought that if Poe was, say, an estate agent, today, he would have written just the lines produced above. He would also have been one of the first in line for a micro and some financial modelling software, if he could get his mind off mysterious black birds for a while.

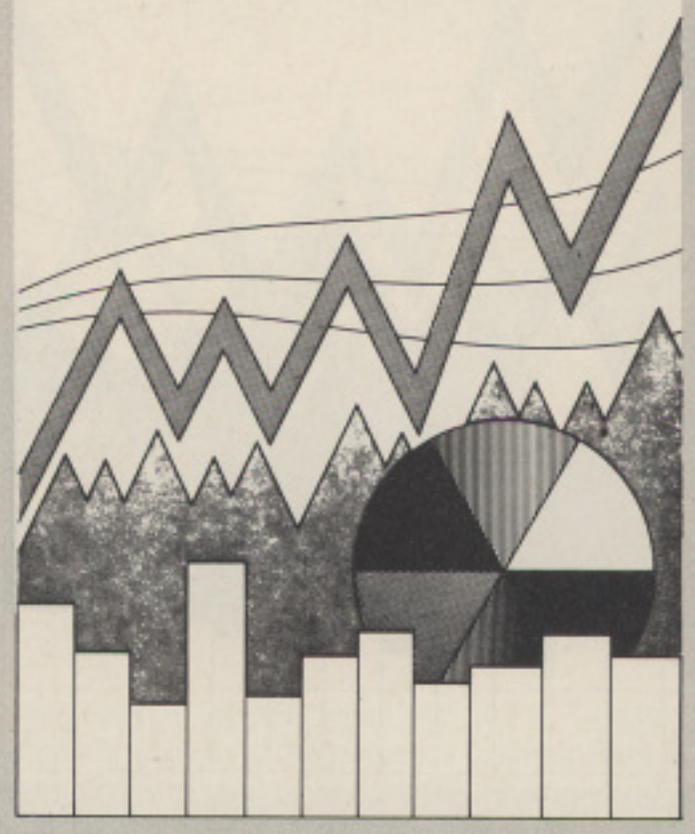
For financial modelling is a wonderful computer tool for calculating the effects of tax changes, price rises, or falls in sales on a business, and producing the five year plan to make the best of things. Come to think of it, Stalin could have done with a financial modeller too. If the grain harvest falls 40% below target, how big does the purge have to be?

Simulations

All this historical perspective stuff is an indirect – very indirect – way of saying that financial modelling, or computer modelling in general, has not sprung fully-formed from the loins of the microcomputer. One of the first things people did with computers was to set up models of various systems, shove various bits of data into the model, and see what came out. These models were no 1:72nd scale Airfix type either, but simulations of national economies or multinational corporations: an example today is the Treasury's model of the British economy, into which the mandarins plug smaller and smaller money supply figures and extract erroneous results about unemployment levels. And just to show that this kind of modelling is not limited to shifting cash and economic factors (but mainly cash) around inside a computer, a certain close female friend of mine at a certain south-coast University completed her Maths degree by working out a computer model of the local airport, predicting passenger numbers and flow; here the varying parameters used were things like opening a new runway or speeding up customs clearance and baggage collection. It must have worked too, since she got a 2.1.

This kind of thing was really only a sideline though. The main beneficiaries of computer power in financial planning were the big companies with complicated structures of operating divisions, each with its own financial peculiarities, where making the wrong strategic business decision could lose millions. Trying out strategies on a model became a vital aid to decision-making, and computer bureaux sprang up with the software to let the companies suck it and see. And everything chugged on very happily, with the big mainframes churning out the business information and the big firms busily making the right decisions and raking in the readies. Then came the earth-shaking advent of – you must have guessed – the microcomputer.

"Trying out different assumptions is what all this is about – and if the results all look bad you can act now to prevent trouble later, by cutting prices or more likely sacking people."



And the microcomputer in turn started one of the most remarkable success stories the computer business has ever seen...

Meanwhile – if Edgar Rice Burroughs (no relation to the Motor-City mainframer) can get away with cliff-hangers so can I – let's look in a bit more detail at what financial planning and modelling are all about.

Related factors

This kind of financial software has a lot in common with the relational database systems discussed earlier in this series. In any business there are many factors that need to be taken into consideration, and these are interconnected or related in various ways. For instance, an increase in VAT means an increase in the sale price of a product, which from previous experience means that sales volumes fall dramatically, which in turn means that cash income falls, stock levels rise, the overdraft grows, profits go through the floor, and so on and so on.

Now in the computer model you can set up all the variable factors complete with all the relationships between them – for instance, cash input = sale price x number sold. Once all the current figures have been entered, you can actually start getting useful results. One typical application would be to project a whole year's business figures making assumptions about things like how much pay settlements will be and how much inflation will rise. You can then say that with these assumptions, this is what the result will be at the end of the year.

Trying out different assumptions is what all this is about – and if the results all look bad you can act now to prevent trouble later, by cutting prices or more likely sacking people. Whenever some smart-suited shyster tells you that Cosmic Chip Corp. expects to do $1,000bn. in sales by year-end 1983, it is more than likely that he is using a financial modelling system with some very odd assumptions of his own built in.

This is the heart of the subject, but of course there are frills you can add. It is sometimes nice to be able to take information from one model and use it to build up another, or to take the model data and word process it before printing so that Cosmic Chip's auditors get a flashy presentation. And nicest of all, you can use the data in the model to produce pretty coloured pie charts, histograms, sales graphs, and other audio-visual slide fodder.

All this is meat and drink to the big firms and the bureaux with their big machines, and has provided the bureaux with a large proportion of their income for many years. Then LO! there was VisiCalc, and the picture started to change.

The editor of this organ – no organ himself I am pleased to report – tells me that *Microcomputer Printout* readers know all about VisiCalc. But for those few people who have been lotus-eating in the South Seas or detained during Her Majesty's pleasure for the past few years, let's see how the Visible Calculator came about.

Electronic sheet

The story starts in 1979, with two talented programmers called Dan Bricklin and Bob Frankston working for a Massachusetts outfit called Software Arts. They saw the expensive financial planning and modelling packages running on mainframes and minis, and realised that at least part of these systems could be implemented on a cheap microcomputer. And what they came up with was VisiCalc, an Apple-based, no-frills fi- ▶

State-of-the-Art Report :

nancial modeller called variously 'a window into memory', an electronic spreadsheet, or even an 'electronic sheet', which I find a rather disturbing concept. What it offered the user was an easy-to-use calculating program, in which a table measuring 63 columns by 254 rows could be filled with alphabetic or numeric entries. Each of these entries could be related mathematically or otherwise to the other, and changing one element changed every other element related to the changed one.

The rest, as they say, is history. But bearing in mind what happened, perhaps the most remarkable thing is that Apple itself turned down the chance to market the product, and Software Arts went to Personal Software of Zanker Road, San Jose, instead. Now Personal Software has sold more than 200,000 copies of VisiCalc worldwide, and those in the know reckon that the program has been responsible for the majority of new Apple II sales. People wanted the program, and were forced to buy an Apple II to run it on, since it was written in 6502 machine code in Apple format. Poor old Apple – it could have made even more money.

This meteoric success naturally led to look-alike products hitting the market, since the most obvious thing VisiCalc couldn't do was run on a variety of machines – particularly CP/M machines. Interestingly, as VisiCalc is not exclusively a financial modeller, the followers fell into two categories; one was composed of pure VisiClones, mostly for CP/M, and the other was made up of microcomputer implementations of the complex financial planning systems running on the mainframes. We'll be looking at both types in more detail later on, since there are more and more of them appearing in the UK every month.

But meanwhile (again), what were those big-machine bureaux up to? After all, they were seeing prospective customers of theirs being seduced by the mouth-watering idea of financial modelling on the desktop. What could they do about it?

The response of Comshare, which claims to be the market leader in both software packages and bureau services for this application, was the simple and classic 'if you can't beat 'em etc.' Until recently, the cheapest Comshare financial modelling package cost around £50,000 and needed a mainframe to run on; but now the push downmarket is on.

Bureau service

Nigel Pendse, marketing manager for Comshare's financial planning products in the UK, is by no means embarrassed by being dragged down into the micro arena that other big-machine firms find demeaning. He feels that the expanding market is big enough for everybody. "The way we see the market developing is into various areas – there are three so far," he says. "There is the stand-alone microcomputer system, the in-house mainframe or mini system, and the bureau service. It's true that the micro packages like VisiCalc are taking the low end of the market, and that the top-end micros are pushing the bottom end of the mini/mainframe business. But the mainframe systems have moved up-market into a different class of problem, and our bureau services haven't suffered at all."

Pendse feels that it is important for Comshare to get into all three areas, and points out the company's moves to do just this. From the mainframe-based Wizard package the next step was MicroWizard, a cut-down version for CP/M machines. Then at the beginning of the year came Fastplan, developed in the UK, which is outwardly very similar to MicroWizard. "But Fastplan doesn't upgrade to the mainframe product, while MicroWizard builds up," says Pendse.

"In larger businesses, it is often useful to be able to 'consolidate' data from different models; that is, to take information from different models and build it into one big model."

After this, Comshare was stuck. Below Fastplan was the VisiCalc preserve, and the company just didn't have the experience to compete there. But there is always an answer for big companies in this position; buy one of the minnows.

Comshare bought out Advanced Management Strategies of Atlanta, Georgia, which already had a distribution network in the US for its Target VisiClone package. According to Pendse, his company did not think much of Target and worked with the new acquisition to produce the successor. The result is Plannercalc, which will be available in the UK soon. Price will be well under £100. "It is cheaper than VisiCalc, and obviously we are going to say it's better," says Pendse. The original Target is still on sale from Comput-a-crop in the UK, and Jenny Wilson's firm will also be selling Plannercalc. Both are purely stand-alone CP/M packages.

But the original Target will set you back around £140 – something like twice the expected price of Plannercalc. True, Target does have a few features that VisiCalc doesn't, like a command language that enables the user to enter relationships between items in the model in a simple and 'English-like' way. But Target's models can only have a maximum of 1,000 elements, compared with VisiCalc's 16,000-odd, and each element can only have 11 digits compared with 14.

Report generator

The main advantage Target has over the leader is that it includes a report generator section. Like the report generators in database management programs, this lets the user print out the information in the model in any way he likes, using whichever relationships and bits of information he needs to help with the business decision. The printing format can be altered to suit the data being printed as well, but Target does not support any graphics output from its models. Apart from this report generator – and all the mainframe packages have similar or better ones – Target is very much in the VisiClone category. As is the next of the CP/M look-alikes, SuperCalc from Sorcim Systems of Santa Clara in California, as even its (trademarked) name indicates.

SuperCalc is probably closer to the VisiCalc concept than any of the other competitors on the market. Most of these, like Target, force the user to produce a model on paper first and then go through a series of menu choices to build up the model on the computer. And then all the data has to be added as well... But SuperCalc lets you put the data straight into the model's grid displayed on the screen, just like VisiCalc; and even the commands the user gives the system are the same, with the familiar '/' followed by a letter chosen from most of the alphabet. SuperCalc's grid size is 63 columns by 254 rows, once again exactly the same as VisiCalc's.

So what are the differences? Laurie Bright of LSI Computers, one of the dealers offering the package, singles out extra user-friendliness. "A Help function is provided, so that typing in '?' at any stage during work puts advice about that stage on the screen," he says. Hitting 'escape' after reading the advice puts you back into the model exactly where you were.

Another new and useful feature enables the user to protect certain fields against accidental change, and having recently tried SuperCalc, I can testify that this stopped me

making embarrassing mistakes on various occasions.

Help function

Bright's company is also known for selling WordStar and other products from MicroPro International, so it seemed reasonable to ask him whether he had taken a look at any other financial modellers for CP/M – particularly MicroPro's own, inevitable called CalcStar. "We've looked at a couple of them," he says, "and I'm told that CalcStar is very like SuperCalc but very much slower. It seems to be about five times slower, in fact." So despite LSI's success in selling WordStar for its own machines, particularly the new and cheap M-Three, it will only be offering SuperCalc as its VisiClone. The price is £190, and after using it from scratch – starting without the manual, against all the advice I give to other people – it seems worth the extra cash. As well as the Help function, another bonus is that SuperCalc lets the user produce much *better-looking* output, with long headings and some neat print formatting facilities.

Sorcim Systems, inventors (or at least they invented the new bits) of the package, has a good chance of having the CP/M equivalent of VisiCalc on their hands. For Adam Osborne, whom God preserve, of Hayward CA struck a deal with Sorcim that gave Osborne rights to give away a copy of SuperCalc with every Osborne 1 computer sold. Now this is a neat deal. The Osborne sells well – $1m of business in the UK in the first six weeks ain't bad – because of the free software he throws in. And every Osborne sale means another copy of SuperCalc going out and bigger financial dividends for Sorcim through their stake in Osborne's firm.

As for CalcStar itself, perhaps LSI gave it too bad a press. It has all the features you would expect of a typical clone, but has the added advantage that CalcStar files, the models that is, can be interfaced with WordStar. So before printing out the model, complete with optimistic assumptions, to show the bank manager you can use it as a WordStar document file and edit it to look nice with all the bolding and underlining needed to satisfy your aesthetic sense. And naturally, the CalcStar files also fit in with MicroPro's other ***.Star** products (that's an in-joke for CP/M fans), including DataStar and InfoStar. Oh, by the way, CalcStar will cost you around £150.

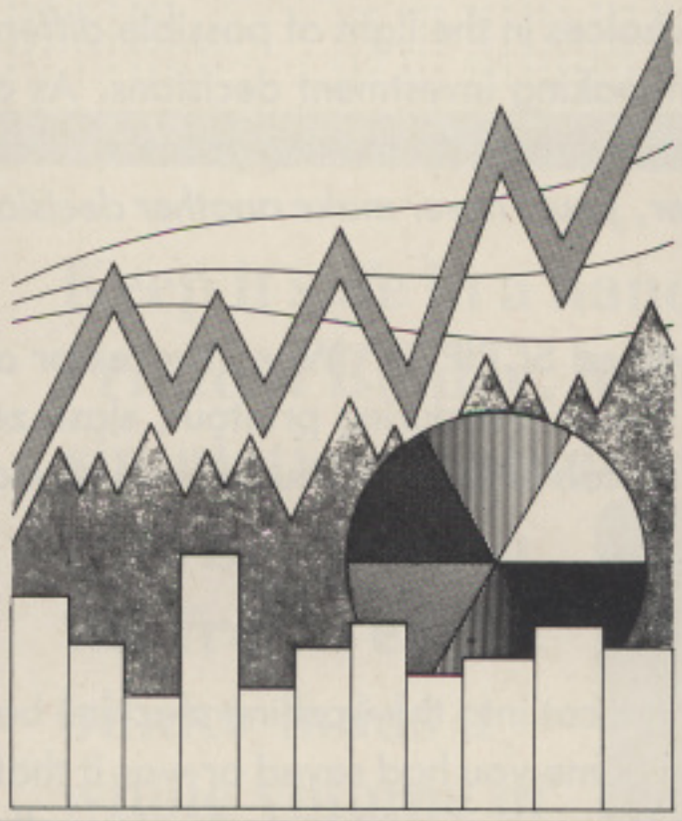
Statistical Analysis

The same approach of letting the user word-process his models has been adopted by Vector Graphic, which has yet another CP/M product called Execuplan for its range of Vector systems. Following the launch of Execuplan 1, Vector's UK distributor Almarc Data Systems is now offering Execuplan 2 at around £150.

This product is something of a bridge between the simple electronic spreadsheets and the mainframe financial package emulators. Besides the spreadsheet calculation stuff you would expect – and Execuplan's model size is limited only by the amount of memory space on your machine, in both dimensions – many other useful features are tacked on. The package will do statistical analysis of the model data, performing arcane functions like curve fitting, exponential smoothing, the wonderfully-named Box-Jenkins, stepwise regression, and other things that statisticians love and I can't understand. Like Target it has a command language and a report generator. But the important new features are the handling of data in different models.

In larger businesses, it is often useful to be able to 'consolidate' data from different models; that is, to take information from different

"...some micro modelling packages are pushing up-market, including a lot of the features normally associated with timesharing bureaux."



models and build the different bits of information into one big model, changing the calculations as necessary. Alternatively, and easier for the package's programmer, the modelling software can simply allow data from different models to be merged and printed together as one big model, but without using the merged data for new calculations.

Vector's Execuplan gives you the second of these facilities as standard, and the first, more complex one as an option.

Also provided is a way of producing files of standard data, like the Government's inflation forecasts or the company's pay settlements for the previous year, and merge these into any model or models on the system. Then again, Execuplan lets the user write little program routines for the model to handle particularly complex relationships between elements, as sometimes the standard relationships provided are just not enough.

I first asked Almarc software support man Paul Chambers about Execuplan 1, and he somewhat stiffly reminded me that "we've now moved on to 2." He described the product as "keyed to other Vector software," particularly the highly-rated Memortie III word processor. But despite Apple's experience with VisiCalc, it seems that it is not Execuplan that sells Vector Graphic machines. "It seems as though everyone buys Memorite for their machine, and maybe one out of every three buys Execuplan as well."

Additional tool

Comshare's Pendse echoes this view, saying that "we see everybody with a micro on the desk doing other jobs, and buying financial modelling software as an additional tool." He also feels that the buying of a micro just because of the financial modelling program available on it is not as common as people believe. "Customers tend to realise they need more computing power if they buy a micro just for modelling," he says. "They still have a micro, but know that a mainframe modeller is needed for the big jobs."

Perhaps Pendse is biased because he works for a company selling mainframe modelling packages and services. But the outline applications he gives for the three market areas seem reasonable enough. "At the very low end, you're dealing with perhaps 1,000 numbers in a model that is very much two-dimensional [a spreadsheet, in other words]. The middle area is sort of two-and-a-half dimensional, with maybe 5,000 numbers or so [modellers with consolidation of data from different models]. And on mainframes you can be dealing with maybe 100,000,000 numbers in N dimensions with relationships between the elements in each dimension."

A typical example of this last big one is a company with three structures; the pecking order of the company divisions, the product structure, and the geographic structure. Each of these would be a different dimension of the model, and elements of each would relate to the others. A big job for the Apple II.

But some micro modelling packages are pushing up-market, including a lot of the features normally associated with timesharing bureaux. One of these is Mars, from Sapphire Systems of Benfleet in Essex, and pretty impressive it is too.

Mars, the Management Accounts and Report System – damn clever, these acronyms – is one of those menu-driven packages we mentioned earlier, where the user has to step through a set of multiple-choice screens to set up the structure of the model before entering data. Compared with VisiCalc and SuperCalc, which put you straight into the spreadsheet, Mars is slow to get started. But Sapphire Systems claim that this actually ▶

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◀ makes the system easier for an unskilled operator to use properly, although you don't often see difficulty of operation being cited as a criticism of VisiCalc.

Anyway, once the model is set up the calculation parts of the model are entered. Mars gives you some neat commands apart from the usual mathematical and logical ones, but the drawback is that these extra commands have to be loaded in from another disk, involving saving the main program and then reloading it.

Consolidation

But apart from purely operational problems, and the small size of the maximum matrix – a quarter of VisiCalc's capacity, to keep the speed high with complex calculations – Mars has a lot to offer when the time comes to analyse the data you end up with from the model. Apart from the report generator implied by the package name, there are so many analysis tools that there's no room to list them here. But the consolidation of models, that is the merging of multi-dimensional models, is comprehensive and worth mentioning.

Users might wonder why, with all this information manipulating stuff, Mars has no facilities for producing any graphics output for easy-to-understand results presentation. In a package costing £400 you would have thought that.... but let's not carp. It's a powerful system.

And now we come to the most powerful micro modelling package of all, which the editor (he who must be obeyed) again tells me you know all about. This is MicroModeller from Intelligence UK, also sold by ACT Microsoft. Now the editor might believe you know it all because of his excellent article on the subject last year, and who am I to argue.

Suffice it to say that the original scheme came from Ferox (that's Latin for bestial) Microsystems in the US and was completed by two refugees from one of the big bureaux who left to set up Intelligence UK in Wimbledon. And it has, for around £500, the most comprehensive list of features around.

MicroModeller, as I'm sure you'll remember, does everything we've talked about in this article only more so; and it does it using a matrix twice the size of VisiCalc's. Consolidation and report generation in all their forms are in there as standard, and the only thing you might miss is all that Box-Jenkins statistical stuff. Remarkable thing that it is, it still runs on a 64k Apple (including the Pascal language card, since the package is written in that fashionable language) as well as on CP/M machines.

Currency conversion

Personal Software came up with a super-VisiCalc of its own called Desktop/Plan II, written in Applesoft Basic for the Apple II and available from dealers for around £130. Cast an eye over the specs, for at that price it looks like a bargain. It has big-machine features like colour statistical graphics, a report generator, special calculations built in, the facility to take in standard data from another file, consolidation in various styles, and so on. One feature it has is only matched by MicroModeller; the trick of automatic currency conversion when you consolidate models from, say, the French or Mongolian subsidiaries into the overall company model. And like Execuplan from Vector Graphic, the Desktop/Plan II spreadsheet is limited in size only by the size of the memory in the machine – handy now that you can buy 128k add-on memory boards for the Apple II's expansion slots. Not to mention the 256k you can cram into the Apple III.

Meanwhile, they were also developing a whole range of Visi.* (another CP/M joke) products on the market from the company, all of which can swap data between themselves and VisiCalc. There are VisiTerm, VisiDex, VisiPlot and so on, and to 'improve its corporate identity' as well as celebrate 200,000 VisiCalc sales, Personal Software has changed its name to the rather sickly VisiCorp. Which is odd really, since at least two of the Visi.* products have been written outside the company, but that's the way it goes. ▶ 97

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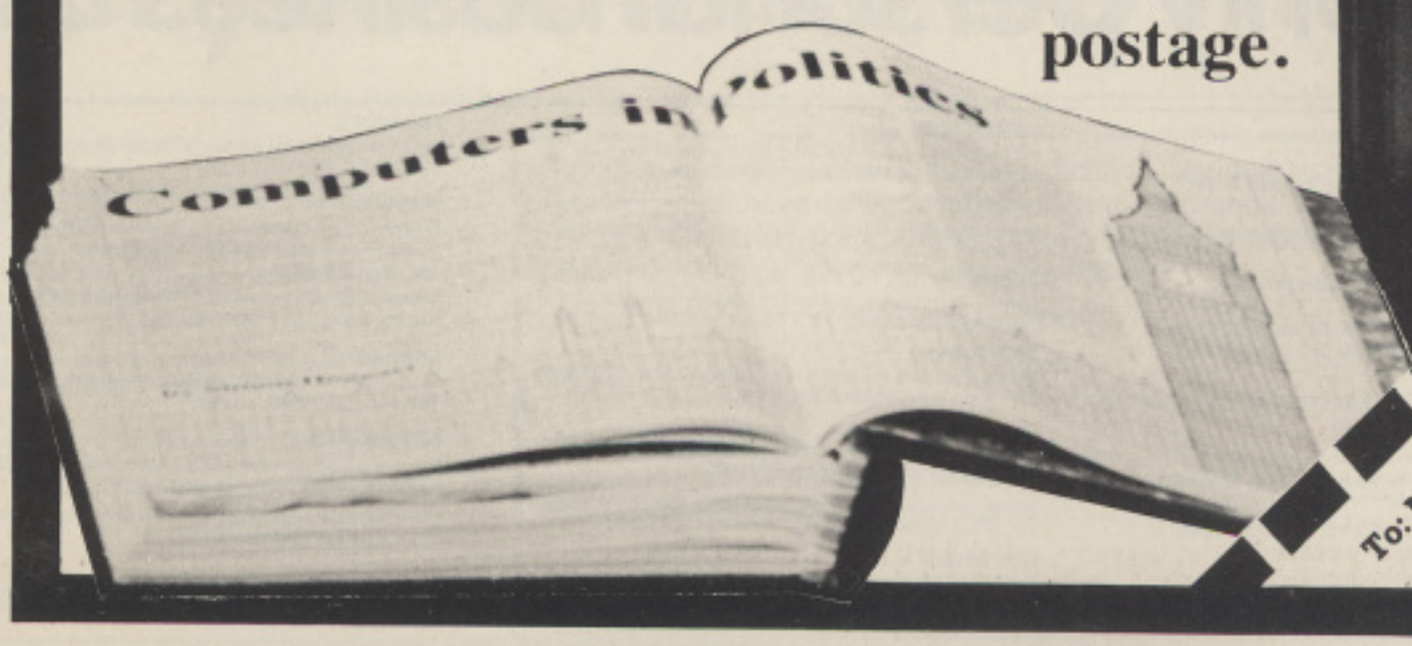

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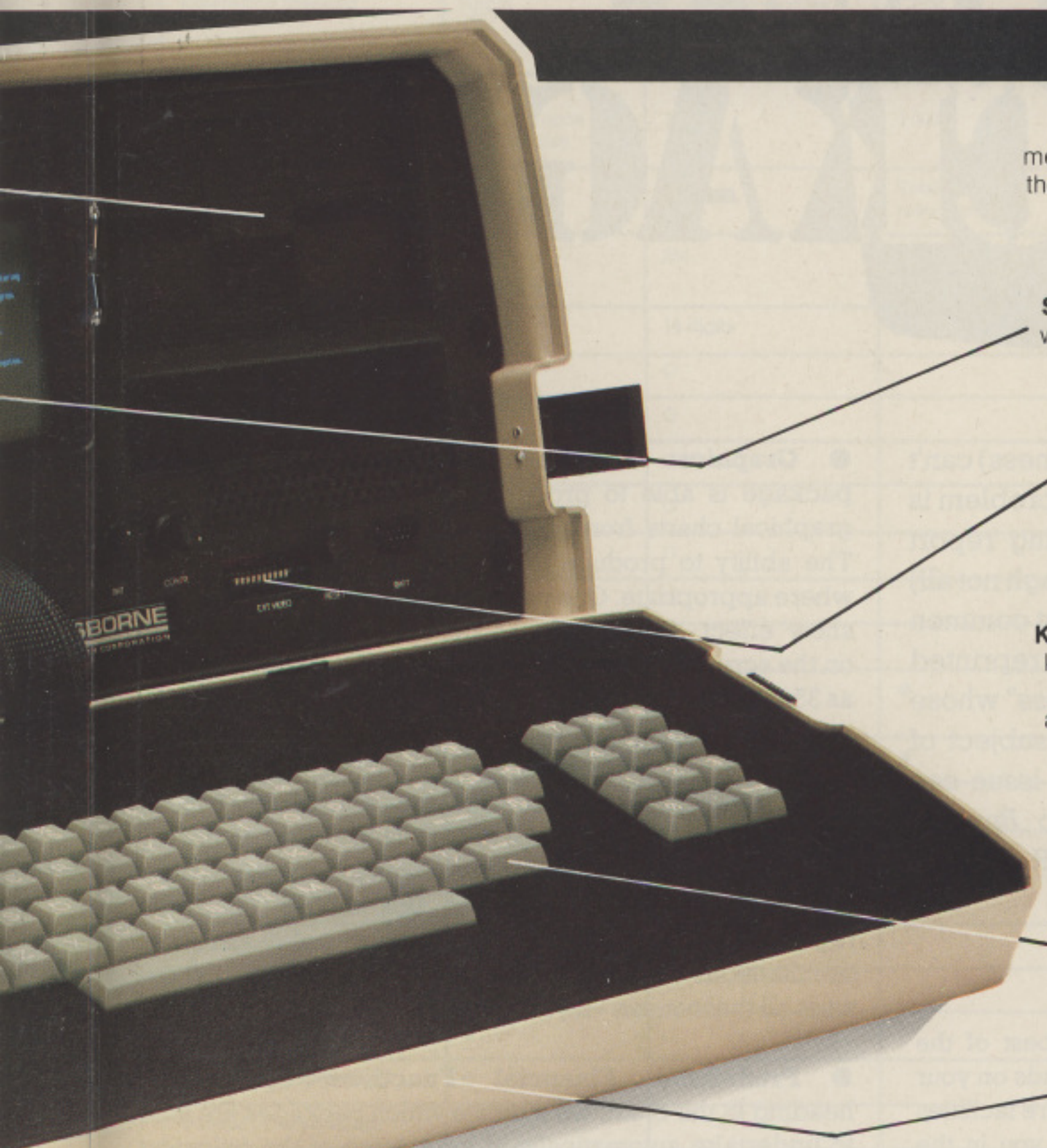

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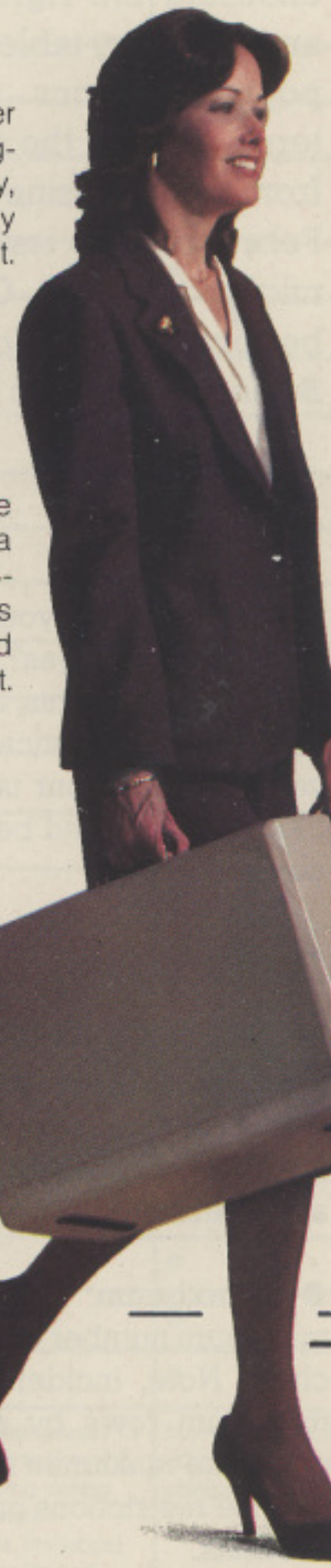

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WHICH PACKAGE?

Once you've decided that life (or your business) can't go on without financial planning, the next problem is choosing the right package. The following report and summary table compares several (though not all) popular versions – and explains all the most common terms used in the application. It has been reprinted from the magazine "What to Buy for Business" whose February 1982 issue was devoted to the subject of microcomputers. Complete copies of the issue can be obtained (price £20) from: *What to Buy for Business,* 11 Kings Road, London SW3 12BR.

How then do you go about choosing the best of the available packages? The answer is that it depends on your exact requirements, as some packages offer more facilities and more sophistication than others. To help you in the selection task, our table gives all the information you are likely to need and below we go on to explain each feature covered.

● **Maximum Number Of Variables/Cells:** As explained above, the packages operate by holding information in a large matrix with the box formed by the junction of each row and column within that matrix known as a 'cell'. The maximum number of cells is indicated in the charts, and this is usually more than sufficient for most applications.

● **Maximum Number Of Columns/Rows:** The maximum number of columns and rows is also shown in the chart. Note, incidentally, that a simple multiplication of maximum rows by maximum columns does not always equal the maximum number of cells - this is because there may be restrictions on particular combinations of rows and columns.

● **Maximum Field Size:** This shows the largest number you can hold in the cell of each matrix (eg, 16 digit numbers etc.).

● **Graphics:** The chart indicates whether or not the package is able to produce automatically certain basic graphical charts from information held within the model. The ability to produce these in colour is also indicated, where appropriate. One package is able to produce a 'slide show' effect - various graphs and charts can be displayed on the screen at the touch of a button in much the same way as 35mm photographic transparencies are displayed from a projector.

● **Statistical Analysis:** The chart indicates those packages able to undertake at least some of the following statistical analyses on the data held within the model: curve fitting; exponential smoothing; Box-Jenkins; stepwise regression; moving average; seasonal analyses; simultaneous equations (if you're a statistician, you'll know what all these mean - if you're not, don't bother).

● **Predefined Financial Functions:** Under this heading in the chart, we indicate which packages are able to undertake automatically at least some of the following functions: net rate of return; net present value; pay back period; time interest earned; depreciation; mortgage amortisation; lag (ie, tax paid one year later).

● **Command Language:** A command language provides increased flexibility for the user to define complex relationships betwen the various aspects of the model eg, x equals the greater of a or b). It also assists in the production of printed reports. In effect, it is a simplified programming language.

● **'If...' 'Then...' 'Else...' Logic:** This is usually associated with command language (above), and it is a type of logic which increases the flexibility of the model (eg, **if** profit is greater than 2, **then** tax equals profit divided by 2 or **else** tax equals 0).

● **Analyse:** Some packages will enable the user to identify all the data and logic elements which make up a particular item. In more complex models it is sometimes difficult to be certain how a particular figure is calculated because of a 'chaining' effect from one part of the model to another. A sales forecast, for example, may take into

Financial Planning Software Packages:

Name Of Package	DESKTOP/PLAN II	VISICALC	TARGET	EXECUPLAN 1	MARS	MICROMODELLER
Price	£130	£60-£130	£143	£150	£400	£595-£645
Language	Apple soft	Assembler	Basic	Machine code	Basic	Pascal
Operating Systems	Apple	Apple, Commodore, CP/M, TDOS, IBM Hewlett Packard, Atari	CP/M	CP/M	CP/M	Apple, CP/M
Maximum Number Of: Variables/Cells	Depends upon machine size	16,002	1,000	Depends upon machine size	Up to 4,000	32,000
Columns	13	63	Total of 90 rows & columns	Depends upon machine size	99	Indefinite
Rows	100	254	Total of 90 rows & columns	Depends upon machine size	999	Indefinite
Max. Field Size	9 digits	14 digits	11 digits	16 digits	16 digits	7 digits
Graphics: Bar Chart	●	O				●
Histogram	●	O				●
Line Graph	●	O				●
Pie Chart	●	O				●
Colour	●	O				●
Slide Presentation		O				●
Statistical Analysis				●		
Pre-Defined Financial Function	●	●	●		●	●
Command Language			●	●	●	●
If-Then-Else Logic	●	●				●
Analyse			●	●	●	●
Impact Analysis			●	●	O	●
Risk Analysis					O	
Goal Seeking				O	O	●
Basic Consolidation	●			O	●	●
Currency Conversion	●				O	●
Partial Consolidation					●	●
Consolidate Different Items	●			●	●	●
Monitor Progress	●			●	●	●
Report Generator	●		●	●	●	●
Calculation	●	●	●	●	●	●
Standard Data User Routines	●			●	●	●
User Routines				●	●	●
"Split" Data		●				●
Own File Structure		●			●	
Access To Other Files	●	O		●	●	●
Back-Up Programme		●	●	●	●	●
Scaling	●		●	●	●	●
Comments	Maximum size of matrix depends on memory size of machine. Figures quoted are for 32K Apple. Good value.	Separate packages available for graphics and statistical analysis. Not the most sophisticaed package, but offers enough facilities for a lot of people and good value.	Separate packages available for graphics, statistical analysis, financial functions, consolidation and user routines.	Aimed at Vector Graphics users and has the advantage of being capable of interfacing to other Vector Graphic packages such as Memorite WP system.	This system is easy to use and is well worth considering unless graphics are important, Statistical analysis is limited, but other packages don't have it all. 'If-Then-Else' logic is also limited to 'if only'.	More facilities than the other packages but also complex to use.

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● 8 channel 8-bit D/A convertor	£350
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● digital data input unit, 64 bits	£400
● digital data output unit, 64 bits	£350
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WHICH PACKAGE?

account historical sales data, price comparisons and economic indicators but the 'analyse' feature will enable all these factors to be identified quickly.

- **Impact Analysis:** This allows you to monitor one specified variable in the matrix so that the system shows its changing values as the user amends other parts of the matrix.
- **Risk Analysis:** The table indicates those packages providing facilities to undertake some form of risk analysis so that the risk associated with certain elements of the model can be determined.
- **Goal Seeking:** With this feature the user is able to set particular targets and the model will show the performance required to achieve them (eg, target is profits to increase by 50%).
- **Basic Consolidation:** Many users of financial planning models require the facility to consolidate information held in various models. It may be that the separate 'income' and 'expenditure' models need to be consolidated to provide a 'profit and loss' statement or it may be that models relating to different companies within a group need to be merged. The table shows those systems with basic facilities.
- **Currency Conversion:** Those companies with overseas subsidiaries will require currency conversion during the consolidation process and some packages will provide this facility.
- **Partial Consolidation:** Those companies owning less than 100% of a subsidiary will wish to consolidate only the appropriate percentage of that subsidiary's information and, again, certain systems provide this facility.
- **Consolidate Different Items:** Another form of consolidation is to merge, and perhaps compare, but not add, data from different models. It may be, for example, that you prepare a 'budgets' model and an 'actuals' model which need to be consolidated.
- **Monitor Progress:** Where the situation described above exists, some form of progress monitoring is required. Some packages are able to monitor budgets against actuals.
- **Report Generator:** The ability to generate 'tailor-made' printed reports for management information purposes is provided by some packages.
- **Calculation:** All packages will provide at least some of the following types of calculation: arithmetic operations (plus, minus, divide etc.),; minimum/maximum; cumulation; average; grow by.
- **Standard Data:** Until the advent of desk-top computers and associated packages, computer bureaux had a near monopoly on the financial planning market. Although very expensive compared with the 'desk-top ' solution, one advantage retained by the bureaux is the facility to access a data base of financial and econometric data. Various statistics from governmental and other bodies (eg, inflation forecasts) can be taken into account.within the model. We are unaware of anyone offering a similar service to users of the systems included in the evaluation.
- **User Routines:** This column indicates those packages providing facilities for the user to incorporate small programs or routines within the model to cover complex relationships etc.
- **Split Data:** This column indicates whether or not the user is able to view different parts of the model at the same time. This is usually achieved by a 'split screen' (explained previously).
- **Own File Structure:** This indicates those packages relying on their own file structure for data, as opposed to making use of a conventional one where the data can be manipulated by other application programs.
- **Access To Other Files:** Some packages will allow the user access to other files, usually to transfer data. It may be that information held in the sales ledger is applicable to a particular model and in such cases it is advantageous to be able to obtain that data as and when it is required.
- **Back-Up Copy Of The Program:** Any floppy disk is liable to damage which would render it 'unreadable' by the disk drive. Program disks are no exception and if you need to buy a new one each time it is damaged then this could be quite an expensive operation. Various procedures apply to copying different programs, so it is always a point worth checking out. Some, packages will allow you to copy the program itself while others require you to send back your disk to the supplier for replacement (at a cost and with at least some time delay).
- **Scaling:** Some packages allow numerical data within particular columns and/or rows to be 'scaled' (ie, all figures in this column represent thousands of pounds).

Conclusion

All of the above should be a pretty comprehensive guide to the features to look out for. Having read all of this, it should be clear just how sophisticated these packages can be as a management tool. It may well be worth getting a computer mainly in order to use one of these programs, and if you are getting a.computer anyway, their relatively low cost should make them more attractive still. Now on to the tables.

Financial Planning Software Suppliers:

Below are originators, distributors or in some cases principal suppliers of the financial planning packages mentioned in the table.

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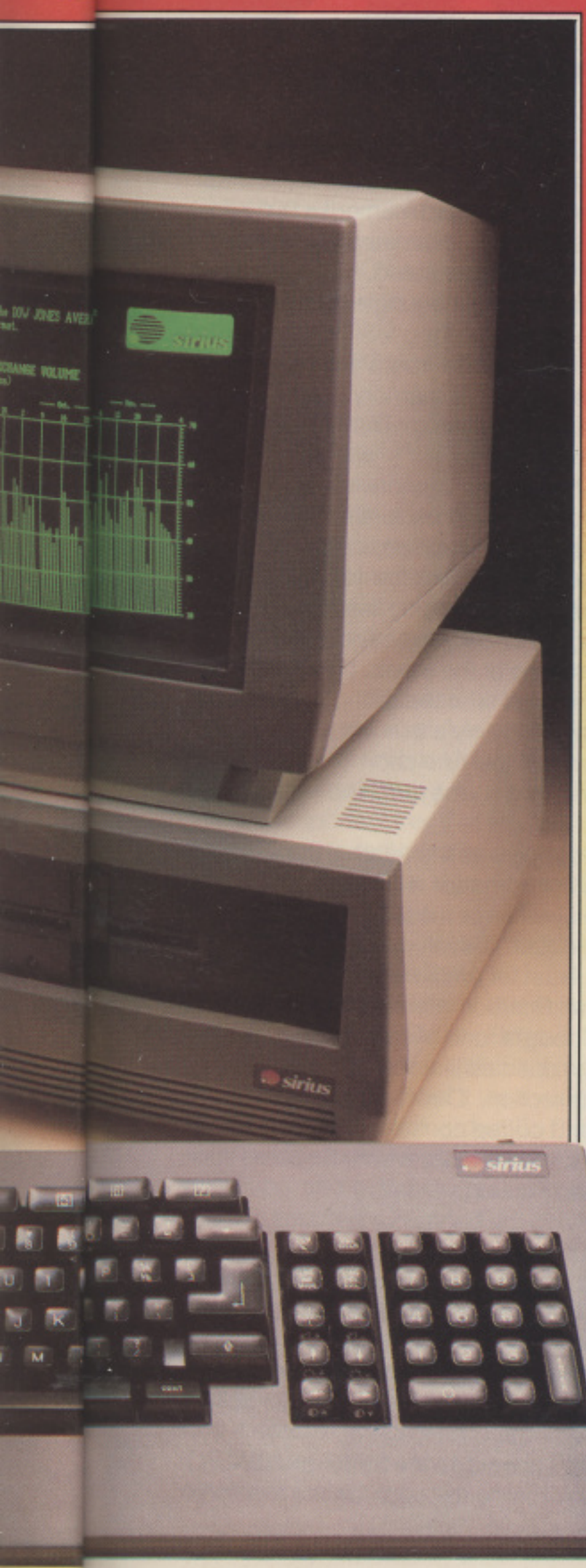

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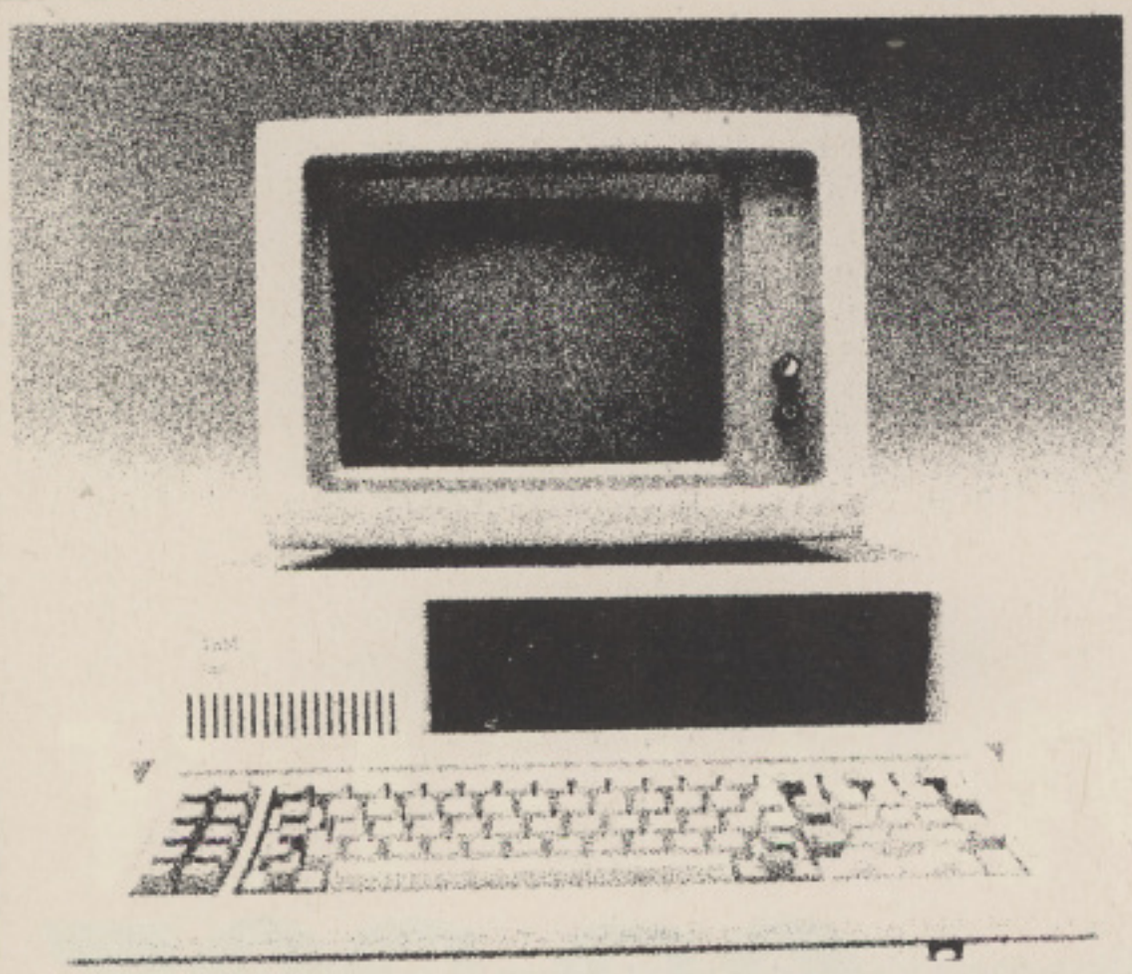

IBM vs Sirius

Which of these two 16-bit Super micros will win?

"Gentlemen, gentlemen, please. I need complete silence for this, one of my most delicate dissections. Before you lie two species from the genus Bigsellum Micrus, comparatively new in evolutionary terms but proving already to be a success." The requested hush fell upon the audience, every member of which tensed as the professor carefully placed his dissection implements in neat little rows on the scrubbed table.

Deftly Professor Todd Sweeney removed the outer layers to reveal the entrails, which, bit by bit, he removed from the grey coloured bodies of the two microcomputers. Slowly, and with the care and precision that had won him international fame, he removed the hearts of both. He held them up to the enraptured audience. A chorus of gasps went round the room. They were witnessing the heart that was said to make those two species so much more powerful than other species in the same genus.

The professor studied the heart of the matter closely for a moment, savouring, in the theatrical manner he found so useful in amateur dramatics, the collective awe of those who had come to see him perform. Finally, he proclaimed: "This, gentlemen, is the Intel 8088."

Looking back in the lecture notes of the professor's students, the importance of the Intel 8088 became clear. It was a cheap microprocessor that did its calculation using binary numbers that were 16-bits long, twice the length of most of its predecessors. What's more, it had been used in, evolutionarily speaking, one of the most important microcomputers of this decade: the IBM Personal Computer, or IBM PC.

The IBM PC sprang out of the company that produced (and still produces) the dinosaur of computing: the mainframe. IBM came from the same mould: it was a huge, powerful and dominant company. Any move it made sent tremors through the whole computing industry, though for a while microcomputing managed to scurry unnoticed around its ankles.

No sooner had IBM decided to make a micro than Chuck Peddle, the man who designed and populated the globe with Commodore PETs, determined to produce a strikingly similar machine, which can be seen in the UK bearing the name Sirius.

Both the Sirius and the IBM PC represented an important development in the micro industry, because they were the first cheap business micros (both costing under £3,000 including floppy disk drives for storing programs and data) to use the powerful 8088 microprocessor.

Naturally, the professor could not pass up the opportunity to open up the Sirius and IBM PC to find out what was inside. For example, the disk drives. Careful examination revealed that the Sirius had disks that could memorise 600 Kilobytes each, whereas the IBM PC he examined offered only 160 Kbytes each. Would this, he speculated, make the IBM PC have a harder fight for survival in the jungle they call personal computing?

He also found big empty spaces, room enough in the Sirius for up to 896 Kbytes of internal memory, the memory the machine uses when it is processing. The IBM PC had room inside for up to 512 Kbytes.

Using that miracle of modern science known as the mains switch, he brought both subjects to life. Two green eyes winked at him, one from each machine.

He noticed that the eye of the Sirius, the 12-inch screen with a special surface to prevent reflections, flashed up a little picture of a floppy disk and an arrow. It was trying to tell him something: to put a disk into one of the drives.

The IBM screens, 12 inches with the anti-glare surface like the Sirius, started off flashing only a thin green line about ¼ inch long. But then it emitted just one short "beep", which told him all was well. If all was unwell, the machine would have emitted two beeps.

Unlike the Sirius, two beeps was the nearest the IBM PC would get to saying what's the matter with itself when first turned on. The Sirius displayed error messages. Some were useful, saying, for example, that a system disk hasn't been loaded. Others less so, at least for the amateur.

At the *MicroComputer Printout* International University for the Furtherance of Thought and Academics' Salaries (MCPIUFTAS), the study of species like the IBM PC and the Sirius did not stop at dissection. Down in the combined sociology, anthropology and coffee consumption monitoring unit was to be found lank-haired ex-Grosvenor Square Riots cheer leader, Professor Zed Pizzaz.

Pizzaz had been studying the behaviour patterns of microcomputers in a societal context for some time now, and he was soon putting the Sirius and IBM PC through their paces.

He wanted to assess input to and output from the micros, and the behaviour between them. The input for both came in the form of the neat detachable keyboards which connected to the main body of the computer via a telephone-type coiled cable.

This, Pizzaz felt, would encourage the Sirius and IBM PC into all sorts of strange environments, such as the lavatory,

V.

Sirius

A very unusual investigation.

where their owner would be able to use up valuable time by programming rather than indulging in the usual aimless contemplation.

The only trouble would be that the screen would normally have to remain outside.

The IBM PC's keyboard was a joy to manipulate. Pizzaz's slender fingers found the soft click that accompanied the pressing of a key particularly satisfying. The keys available rendered the PC's heart, the central processing unit, easy to manipulate.

The Sirius' keyboard was good, but not as good as the PC's, and a few of the keys were not implemented when the machine was running the software supplied. This resulted in dysfunctional behavioural characteristics in certain social contexts; characteristics which Pizzaz noted with pleasure, had yet to be embraced by the lexicographical conventions and norms of the computer's epistemological matrix.

The Sirius processor, in other words, was not capable of understanding some of the signals sent to it from the keyboard. But this was no generic problem. With software that will become available on the Sirius, the appropriate keys will be implemented. Using the word processing package *Wordstar*, which was supplied to Pizzaz in pre-release form, the only important key that wouldn't work was the pound sign. This could be temporarily overcome with a capital 'L' overstruck with an equals sign. The released version should have all the keys working.

Pizzaz's next wish was to learn about the output of the two machines. Interacting with the outside world, as he had said in his paper given at the annual Sociologists' Spheroid Object Used in Game Behaviour (also known as the Sociologists' Ball), is a difficult thing.

Both machines did it via their green screens or an array of plugs on their back-sides. So that a female plug can mate with a male one, to use the parlance of MCPIUFTAS's engineering and psychology departments, standards must be kept.

In the case of both machines, the standard was called RS232. Because they had RS232 plugs on the back, both could be plugged into most serial printers (ones that have to take in bits of information, one bit at a time). But only the Sirius could connect to a parallel printer (one that can cope with a number of bits of information at a time), unless the IBM PC had a special adaptor plugged into it.

Both machines had the capability to talk to networks of other computers.

But the IBM PC, with the backing of IBM and an industry biting at the bit to get in on the act and supply lots of add-ons, was capable of expanding out of recognition, at a cost. A carefully designed "mother board", the printed circuit board that carries the main components, had a number of slots for enhancements as well as extra memory.

Pizzaz, who liked putting things into their societal context and contemplating their role in the demographic fabric, thought that the plan for the IBM personal computers was to link them into an international network. As one of Pizzaz's colleagues, Pierre Shakes from the languages department, had put it: "They are just a few strands in the wide web IBM is weaving over the world".

But being of essentially the same nature, anywhere the IBM PC goes, the Sirius could follow, given Peddle's plan to take advantage of IBM's influence.

Some of Pizzaz's colleagues may have regarded this practice of one machine trying to ape another as constituting a display of aberrant behaviour values. Hardly so. In the world of mainframes, copying IBM is a well-established norm, and arises out of IBM's dominance in the computer manufacturer's social grouping. "The pack leader is often emulated," Pizzaz had observed at a recent sociologists' conference. "Other members of a group copy their leader in order to establish a place in the community. Only a few strongly placed members, with an established position towards the top of the hierarchy and a robust peer group rating can afford to assert an independent role."

Reflecting Pizzaz's own elevated position in the sociologist grouping, the audience had nodded furiously in agreement.

As part of the project, Pizzaz had to assess the appearance of the machines. He had to do this, he explained to the trustees of the MicroComputer Printout Bahamian Investment Fund who had provided the finance, in order to establish their (the machines, not the trustees) role in the display ritual.

Both were attractive, though Pizzaz felt the warmer brown greys of the Sirius, and the ergonomically admirable adjustments that can be made to its screen, would be a little more likely to attract suitable partners.

The design of both machines would, he felt, attract the appropriate people, who he estimated would range from Cortina drivers living in joined-up houses (socio-economic group C1) to Mayfair curb-crawlers and Earl Grey tea drinkers (socio-economic group A/B), and include the normal people in between (who didn't really interest Pizzaz at all).

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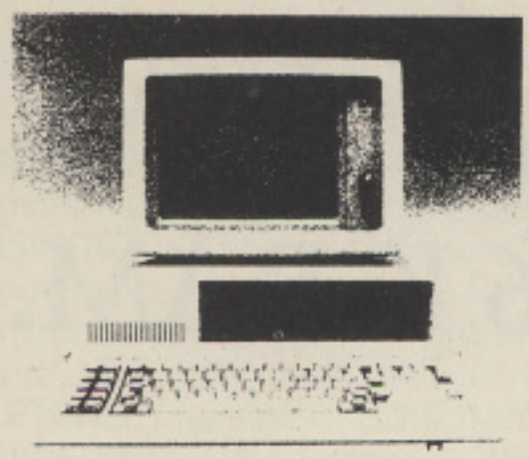

IBM V. Sirius

The IBM PC also had a little extra display ritual supplied with the systems disk. A selection of games, some of which can only be run with an add on colour/graphics board, provided an excellent means of establishing a rapport between human and machine. Pizzaz spent many hours guiltily playing tunes using the music program, and running the mortgage program to work out when he could afford the prenatal infant rehabilitation centre of his dreams.

Before passing on the machines for further evaluation, Pizzaz had to present a report to the MCPIUFTAS Vice Chancellor. He concluded that given the inaccessibility to some of the IBM PC due to its price, the Sirius would be the better bet.

But he also noted that the IBM has the advantage of having the biggest computer in the world behind it, probably offering some of the best support and potential for expansion.

As was his wont, Pizzaz concluded that the choice between the two would have political undertones, as to go for the IBM would involve engaging in a (possibly fruitful) long term commitment. He didn't expect to find a heavy population of either machines in the domestic environment.

The two machines were next entrusted to the technical assessment department. Sid, who was in charge of the assessment, took only a few days to reach a preliminary conclusion.

Sid wrote: "The 16-bit rewrite of the CP/M which was running on the Sirius had two incompatible I/O subsystems which meant we had to bootcopy the system tracks on to the *Supercalc* and *Wordstar* before we could run all the applications packages without a reset. The MSDOS we had up on the IBM PC, which is basically a CP/M with friendlier command level syntax and easier error message codes, performed much the same, but with the 20-bit addressing and 16-bit internal architecture of the 8088, a few lines of Pascal code ran faster than on conventional 8-bit kit. When the 8086 comes on line with the 16-bit data bus, we expect better throughput, though it's hard to tell. The full potential of both systems will be available when 16-bit software, rather than converted 8-bit software, becomes available. The Microsoft Basic 86 was woeful, but a new version is in the pipeline."

"What?" asked the Vice Chancellor, to whom Sid was reporting. Sid went over it again, relating how much of the software written for the machines was converted from software written for the less powerful 8-bit machines like the Apple and PET.

This meant that the full potential of the processor uncovered by Professor Sweeney was as yet not being exploited. As well as this, some of the software for the Sirius could only be run after the machine had been used with different programs by switching the system off and on again.

But as Sid pointed out in his occult way, both these problems should be solved as and when more software becomes available.

One major shortcoming of both was the version of the programming language Basic they used. It had been especially rewritten for the Intel 8088 processor, and as a result rather than being better than the Basic used on the less powerful 8-bit systems, was in many respects worse.

Sid showed the Vice Chancellor a simple example. If either machine was asked in Basic to multiply 0.6 by 100 the answer that came up was 60.00001. The reason for this, again, is that the full potential of the processor hadn't been tapped, and when the suppliers, Microsoft, produce a full blown version of the language, the problem should be solved.

But Sid concluded that using either machine for word processing or financial modelling proved very rewarding. He pointed out that when he searched for a word in a piece of text several thousand words long, it would be found almost instantly, and appreciably faster than with an 8-bit system.

The Vice Chancellor was left with the task of pulling together the reports of Pizzaz and Sid, incorporating the findings of Sweeney, and producing some conclusions for the Micro-
Computer Printout Bahamian Investment Fund trustees.

He thought of doing this with the help of philosophy Professor Reg Toenail, but then he didn't feel like having to spend most of the time defining his terms.

It had been pointed out to him that the IBM PC is not yet available in Britain from IBM. Companies had brought it in on their own behalf, buying it from American stores who obtained deliveries direct from IBM.

This could have meant that IBM would launch a special European version, one sufficiently cheap to meet the Sirius head on. But as things stood, the Vice Chancellor felt that the Sirius offered better value for money: who could argue with more memory at less cost?

Nevertheless, the name alone was enough to attract considerable interest in the IBM, and as Pizzaz had said, the choice is more than a question of price to some customers. Some people want in on the IBM act from the start.

"Gentlemen," said the Vice Chancellor, trying with effort to follow protocol and affect a bow. "Here are the combined reports of the surgical department, the sociology, anthropology and coffee consumption unit and the technical assessment department."

"Good, good," the Trustees murmured in unison, "and which of these two subjects would you say is more likely to survive the rigours of the outside world?"

The Vice Chancellor thought a while, and eventually asked if he might sit down.

"There's not a lot in it, gentlemen. On the one hand the Sirius is cheaper and is highly regarded in terms of design, and on the other, the IBM PC seems better prepared for the moment. A lot of the extras for the Sirius have yet to arrive, and the documentation we had supplied with the Sirius was not the final version..."

The Vice Chancellor's prevarication was true to form. But, as he could have guessed, the MicroComputer Printout International Group, a big user of IBM mainframes, favoured the IBM PC on the basis of the report. Individual MCPIUFTAS departments, on the other hand favoured the Sirius...

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Real computing at a rock bottom price?

by **Richard Pawson**

SINCLAIR'S SPECTRUM

The Sinclair ZX Spectrum is a *personal* computer with a difference: it comes pre-programmed with one man's *personal* vendetta against a massive organisation. Quite apart from Clive Sinclair's unique record of creating high technology consumer products at significantly lower prices, the Spectrum's design clearly reflects the man's resentment at not being given the contract for the BBC Personal Computer. The fact that his ZX81 has outsold all other British micros put together added insult to injury. Hence his determination to produce a higher specification competitor for less money.

Even the colour brochure for the Spectrum reflects this sentiment, with Sinclair himself unambiguously declaring that "We believe the BBC make the world's best TV programmes – and that Sinclair make the world's best computers!" With characteristic dry humour at the press launch he revealed that one possible name for the project had been 'Not the BBC computer'. Having performed our own evaluation and testing, we would *not* go along with Sinclair's claims that his new baby outperforms the BBC Model A on all fronts. It does, however, incorporate a number of extremely sophisticated features that make most other colour home computers look positively neolithic by comparison. In terms of value for money, the Spectrum leaves them all standing – costing £125 for the 16K version, or £175 for a full 48K.

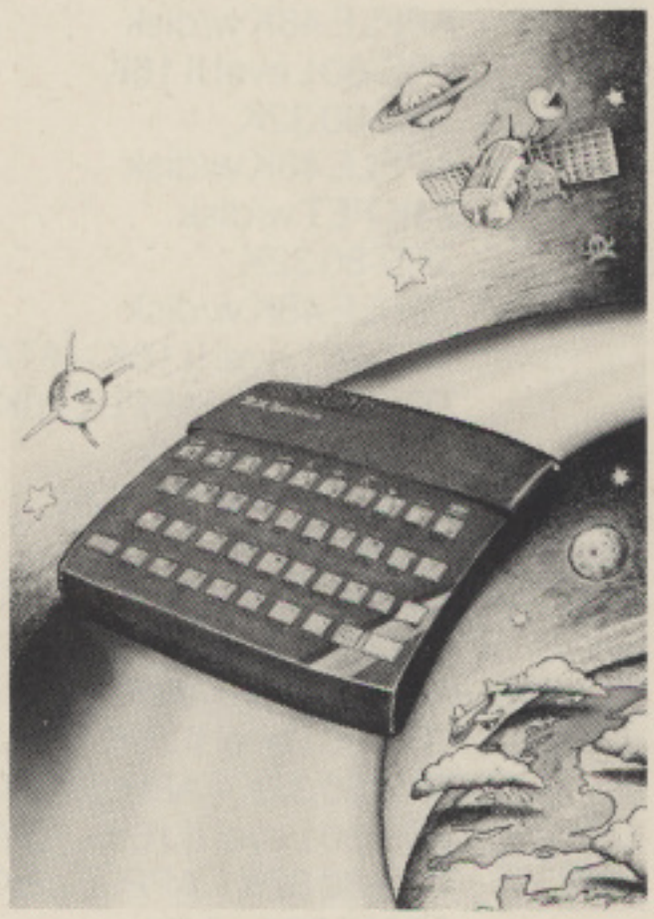
So let's start with a brief run down on the features offered. The ZX Spectrum is a colour home computer which plugs into a domestic TV set. Up to eight colours can be used for text, block diagrams, user-defined characters, and high resolution graphics. It has a keyboard with movable – though not typewriter quality – keys, and a small built in speaker to provide sound effects. It interfaces to a domestic cassette recorder for storing programs – and can load and save them faster than other systems. It is programmed in BASIC (or machine code). Of the 16K of RAM, around 13.5K is usable.

Micro prices

When reviewing a new home microcomputer, mention of the peripherals and expansion facilities is usually left to the end, since few potential purchasers will be inclined to fork out the requisit additional greasy oncers. In the Spectrum's case, however, the low-cost devices under development at Sinclair (to say nothing of the many hundreds of independent small companies) represent a major selling feature.

First, there is a memory expansion: for a cost of around £60 it will be possible to upgrade the 16K machine to 48K with a plug-in pack. That is likely to mean that only those intending to run business applications with the Microdrive will initially purchase the 48K model.

The ZX Printer (available now at £60) will



also run on the Spectrum – and can print in both upper and lower case. The BASIC commands built into the Spectrum can LPRINT to the printer, LLIST a program, or COPY the screen onto the printer – including high resolution graphics. The ZX printer prints up to 32 column width on electro-sensitive paper, at 50 characters per second.

Built into the Spectrum's operating system is the software to drive an RS232 port, and for around £20 you will be able to purchase the hardware part of this interface and thus access a wider variety of printers, modems, etc. This interface also includes a networking system that will allow a number of Spectrum's to share common peripherals – for use in schools, for example.

Great Microdrive mystery

The most interesting development, and the one that is causing Sinclair's competitors the most anguish, is the Microdrive – a mass storage device that can hold up to 100KBytes of programs and data for fast retrieval, yet will cost only around £50.

Again, the BASIC and operating system has commands already built in to handle up to eight Microdrives – which could well make the Spectrum the cheapest business system on the market.

The Microdrive is clearly Uncle Clive's most closely guarded secret, and the compact (3" x 3" x 2") exterior gives no clues as to what it contains. Most pundits believe it to be a 1" disk drive. Our opinion, however, is that it is actually a new form of cartridge tape system – similar to the 'Stringy Floppy' and 'Floppy Tape' ideas already developed. Our reasoning (and it is only hypothesis) is given below – for those who are interested:

1) The name – Microdrive. No matter what the actual performance figures, a disk is a more marketable animal than a tape. Had Uncle Clive developed a revolutionary 1" disk, he would almost certainly have called it the Micro*disk*.
2) Though the data transfer rate is extremely fast (16KBytes per second) the average access time (the time taken to find an item) is not. From the brochure, the figure given is 3.5 seconds which means that the maximum access time should be 7 seconds. But 7 seconds times 16K per second is not far different from 100K – the capacity of the drive. Which tends to suggest that it could be a continuous loop tape circulating at a constant speed. We are certainly prepared to be proved wrong.

Construction

Starting with the outside, the Spectrum's casing is rather wider than the ZX81 but of similar construction: rugged plastic shell and low profile design. Sinclair employs an industrial designer to improve practicality and aesthetic appeal; hence the rainbow flash across the corner of all Spectrum products.

Sockets at the back are for power supply (same transformer as the '81), cassette recorder, TV (the UHF modulator is built into the Spectrum – unlike some home computers) and the expansion port: effectively a continuation of the Z80 bus to drive memory and peripherals.

The screen

The screen is the face of a computer, where it expresses itself, and the lifeless black and white *© 1982 Sinclair Research Ltd* message which appears on switch-on gives

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no clue to the vast range of expressions possible. The screen is divided into two areas; a central portion where programs are listed and output is printed in the form of colourful text and graphics, and an outer border which can be specified as being any one of the eight standard colours (blue, red, magenta, green, cyan, yellow, white and black). The bottom two lines of the screen (i.e. in the border) are used for entering program lines and keying in responses to INPUT statements. If more than two lines are needed then this area is automatically expanded, and the rest of the screen scrolled upwards.

The main screen thus consists of 32 x 22 character positions – which may contain standard ASCII characters (upper and lower case), any of the sixteen standard graphics symbols (which basically provide all the combinations of quarter squares within the block) and your own user-defined characters which can be assigned to any of 21 keys. The latter are very powerful in that they can be used for special games symbols, foreign language alphabets and so on – though of the graphic facilities they are by far the most difficult to use – involving the POKE, USR and BIN functions.

Each of the character positions on the screen has associated with it a set of "attributes" defining its graphic status. This covers the foreground colour (altered by the INK command), background colour (PAPER) and whether or not that position is to be shown extra BRIGHT or FLASHing continuously. This attributes system is similar to that used on Teletext displays and is one of the reasons why the Spectrum is so efficient in memory usage, particularly for graphic displays.

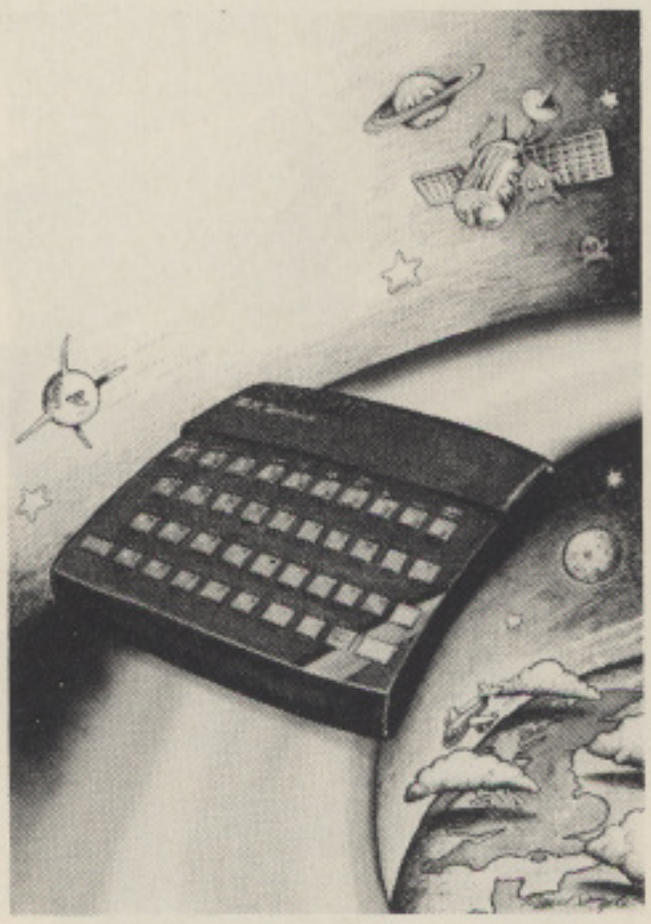
High-resolution graphics

Using the high-resolution graphics (which can be superimposed on any other text or graphic displays) it is possible to turn on, or off, any of the individual 'pixels' on a grid of 256 x 192 dots. Commands are incorporated into BASIC to draw lines, circles and arcs, in order to speed up the design of displays. Though the hi-res graphics can make use of any of the INK colours, it is still only possible to have two colours within any one character position, so you are not completely free to produce hi-res designs in any colours. It does, however, mean that even with a full hi-res display, 9K of user memory is still available.

Keyboard

ZX81 owners will undoubtedly be wondering "Has the keyboard been improved?" The Spectrum's keyboard does have distinct, movable keys – which, though smaller in size, do have the same pitch or spacing as a typewriter, with the exception of the space bar.

The keys, however, are made from rubber (Inside Trader suggests that 'latex' was the material employed) and have a rather spongy feel to them – similar to many pocket calculators. More positive feedback is provided with the help of an audible click



from the speaker for each key press. All keys have an automatic repeat function if held down.

Each of the keys has a multiplicity of functions ascribed to it (as many as seven in some cases), though unlike the ZX81, Sinclair have made good use of colour to avoid too much confusion. We found the labels printed on the surface of the keys difficult to read in some lights, and likely to wear off – though this defect may well be corrected by the time the production models are shipped.

The various functions are differentiated between by means of two different shift keys and a variety of operating modes – indicated by the reversed out letter that acts as the cursor. For example, there is **K**eyword mode where pressing P will cause the word PRINT to appear, **G**raphics mode for special characters and **E**xtended mode for other commands.

This does take a considerable amount of getting used to and is extremely confusing for the beginner. Once mastered, however, it should save time, typing errors and temper. We found it an improvement on typing all keywords out in full.

Alas, editing of mistakes or making alterations to programs is rather less straightforward. The Spectrum uses a similar system to the ZX81, and while this is acceptable on a machine in which memory is the principal constraint, the decision not to offer full screen editing leaves the Spectrum at a disadvantage in comparison with Commodore's VIC. The procedure involves moving a pointer up and down the listing until the erroneous line has been reached, and then selecting EDIT to bring the line down to the bottom of the screen. To be fair, however, this is by no means the worst of the editing systems we have seen.

BASIC

Spectrum BASIC is an extension of the original Sinclair BASIC employed on the '81 and which Uncle Clive claims is "rapidly becoming *the* standard". This claim is presumably based on the sales of over 400,000 ZX80 and '81s. Though it will not be possible to load '81 tapes onto the Spectrum, most programs will transfer across if retyped. The differences appear to be well documented. We noted with interest that the functions READ, DATA and RESTORE are now incorporated – thereby contradicting Sinclair's earlier insistence that the lack of these functions was not a major omission and could easily be programmed around.

Sinclair BASIC is undoubtedly a very user-friendly language – both in things like the one-touch keyword entry system, and the number of very high-level commands for coping with graphics and the like.

Cassette

Many such commands are associated with the cassette system – which has been speeded up *seven times* to 1500 Baud. It now incorporates the means to cope with the widely varying recording levels found on domestic cassette recorders.

In addition to the normal SAVE, LOAD and VERIFY (i.e. check that a program has recorded properly) commands, there is also a facility to MERGE subroutines from tape into program you are developing. Furthermore, the first three can be used not just with programs, but to save arrays of data, any sized sections of memory, and even screens of text or graphics. All of these blocks of data can be saved with names in the same way as programs.

Finally, there are one or two additional features we think worth mentioning. First of these is the BEEP command, which controls a note of specified pitch and duration to be ▶ 97

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MP/1

Though everybody has heard of the programmer's revenge, I have yet to meet the programmer who has taken it. The classic revenge story, of course, is of the programmer who so fixed his payroll entry that if he got fired, when they came to take him off the system, it would wipe out the entire file.

Variants of that have been around for at least fifteen years. And for a long time, I thought that wiping out the file whatever it might be, while not subtle, might still yet be the best revenge. Until I heard the following, which I am told has since surfaced in everything from comics to textbooks. Even so you may have missed it.

It was the early days of time sharing systems. The particular system at the research laboratory in the USA kept on going down, and stopping for no particular reason. Or so it seemed, but it happened so frequently that eventually mischief was suspected.

Mischief was verified. Mischief was a program called RHBOMB, submitted by a programmer whose initials were RH. RHBOMB always seemed to be in the system when the system went down, printing TSS (for Time Sharing System) HAS GONE DOWN.

RH was spoken to, and was told that if it happened again, there would be serious trouble. And RH went away, everyone thought, suitably chastened.

Some months later, a programmer browsing through program listings, came across a program called RHBOMB. Not wishing to get RH into trouble without first checking, he sat down at the terminal to call up the program and look at it.

He pressed the keys to call it up, and then typed in LIST RHBOMB.

The terminal reacted immediately. No listing: instead back came the phrase TSS HAS GONE DOWN. And then the terminal went dead. Whatever he typed in, there was no response.

But this was incredible – a program so virulent that even a simple call to list the contents managed to wipe out the system. The programmer rushed out of the room down to the computer centre to discover, if he could, what had gone wrong, and why it had done so.

He did so prematurely, for TSS, it turned out, had not gone down except at his terminal. This RHBOMB was a very simple program. On being queried, all it did was to send the message TSS HAS GONE DOWN. It then immediately instructed the computer to send, and keep on sending, a continuous set of clock pulses to the terminal, which of course were just at the right speed to lock it. And that, in turn, meant that it was never able to signal back to the CPU that it was ready for the next task.

It was not recorded what happened to the programmer who wrote version two of RHBOMB.

* * * * * * *

The early days of computers were not the most reliable of days, either of machines or equipment. And led in turn to a host of terse and other one liners which tried to aid the weary.

Sattinger's Law:

It works better if you plug it in. (I was for some years to make extensive use of this, and added my own footnote:

Malik's Corollary:

If it still doesn't work, try switching it on.

Others before me had been down this route, and one had produced Caan's Axiom.

When all else fails, read the instructions.

Most of the one liners have been American, but Europeans were not to be left out of this law-making.

There was Hoare's law of large programs:

Inside every large program, there is a small program struggling to get out.

And then there were consultant Tom Gilb's Laws of Unreliability.

Computers are unreliable, but humans are even more unreliable.

Corollary: At the source of every error which is blamed on the computer, you will find two errors, including the error of blaming it on the computer.

Any system which depends on human reliability is unreliable.

Investment in reliability will increase until it exceeds the probable cost of errors, or until someone insists on getting some useful work done.

But the last word on all this has to go to former US television commentator, Eric Sevareid. He was not talking about computers, though he might well have been. And he said this:

The chief cause of problems, is solutions.

ALGORITHMS

What are algorithms, and are they of any relevance to the microcomputer user? Chris Preston looks at solutions to some of the classic problems.

Algorithms form the basis of Computer Science. It is often said that these algorithms are very complicated, difficult to understand, require higher degress of maths, etc. It is also said that if a young maid catches a toad at midnight and releases it after muttering a few words, she will be married within the year. Which just goes to show that you cannot rely on what other people say. Unless those people are writing to you in *MicroComputer Printout*, in which case you may carry on.

Before we get too involved in the subject, perhaps we had better decide exactly what an algorithm is. An algorithm is just a general method for solving a particular problem. For example, consider the problem of getting back into your house after an evening at the local tavern:

1. Select a key.
2. Insert in lock, and turn.
3. If door opens, go to step 6.
4. Select next key and go to step 2.
5. If no more keys, try next house.
6. Enter hall and prepare to dodge flying objects and/or rolling pin from loving spouse.
7. End.

We normally do not need to write an algorithm down for such a simple task: we do it automatically. But there are many cases in maths and in programming, where the method of solving a problem is not terribly obvious, and in these cases we might have to think up an algorithm for the problem before actually sitting down to write the program.

The oldest non-trivial algorithm I know of dates back to Euclid, and gives a rule for finding the greatest common divisor of two non-negative integers. In this article we will be looking at various 'standard' problems of computer science. Many of these require a little more theory than we have room for in a short article, but hopefully your interest will be stimulated enough to make you want to find out a bit more about the subject.

Computer science

One very interesting branch of computer science is comparing different methods of solving problems. The process of analysing algorithms is however quite technical, so we will not go into the theory in any depth here. However, there are many methods which are shown up by such analyses which can be used in ordinary programming. One thing we will bear in mind is how long a particular algorithm takes. Most algorithms work on a set of data, containing say n records. We might have an algorithm whose time is proportional to n and another whose time is proportional to n^2. In general we would prefer the first, be-

cause the graph of n rises more slowly than that of n^2. However, the graph of n might be a very steep one, so that the graph of n^2 does not overtake it for a long while. An example of this is the Insertion sort, which is the fastest sort known for very small numbers of items, say up to 16 or 20, although it gets very slow indeed for large n. The insertion sort is the method you probably use yourself to put a new page in a loose-leaf book. You just look down all the pages till you find the right place, make room for the new item, and then make the insertion.

What sort of algorithms are we likely to meet, and what can we learn from them? One very fruitful area for the algorithm hunter is the sort. The simplest sort of algorithm is also just about the slowest, the Bubble Sort. Say we have n records we want to sort. The way it works is that you start at the beginning of the list, and compare the first two records. If the second is smaller than the first, you swap them. You then compare the second and the third record, then the third and the fourth, up to the nth. After the first pass, the largest record will be at the end of the list, so next time we only need to compare up to n-1, and so the procedure goes on. It gets its name from the way the largest record in the set rises up through the set like a bubble in a liquid. The time taken for the sort increases as n^2 so if you double the number of items, the time taken goes up by four. Alternative sorting algorithms can achieve a sort time proportional to $n^{1.25}$ or better.

'Greedy' algorithms

From an algorithmic point of view, why is this method so bad? If we have two records which are next to each other and in the correct order, they will still be compared on each pass of the data, despite the fact that they will never be swapped. An ideal algorithm would examine each item only once, and then magically put them all into the correct order. An algorithm which only needs to examine its input data once is called a 'greedy' algorithm.

Another problem which can be solved using the greedy method is the 'Knapsack Problem'. We have a number of objects which we want to put into a knapsack, which has a capacity C. The weights of the objects are held in array W(I), and for each object we add in, we get a profit P(I). We can also add a fraction X(I) of an object, in which case we get a profit of X(I)*P(I), at a weight cost of X(I)*W(I). The idea is to fill the knapsack so as to maximise profit. Several simple algorithms spring to mind, such as always to add the object with the most profit. This, however, is not brilliant, because although total profit rises quickly, we cannot add many items before the knapsack is full. Learning from experience, we might decide to add the lightest object next, but this doesn't work either, because the profit just doesn't come in quickly enough. The optimal algorithm is to add the object which gives us the maximum profit for the capacity used. In other words, the object with the highest value of P(I)/W(I).

The problem becomes even more interesting when it comes to writing a program to fill the knapsack. At first sight the simplest way is to place the objects randomly in the array, then search for the one with the highest value of P(I)/W(I). This is very inefficient, because we are calculating this ratio for each unused object, then picking an object and starting all the calculations over again! A better way is to calculate all the P(I)/W(I) at the start and put them into another array, V(I). However, we still have to search through V(I) each time we pick an object, so the method is still very wasteful. To make the method greedy, we have to sort the objects into descending V(I), so that we know exactly where to find the next object. In fact, we do not even need to store ▶

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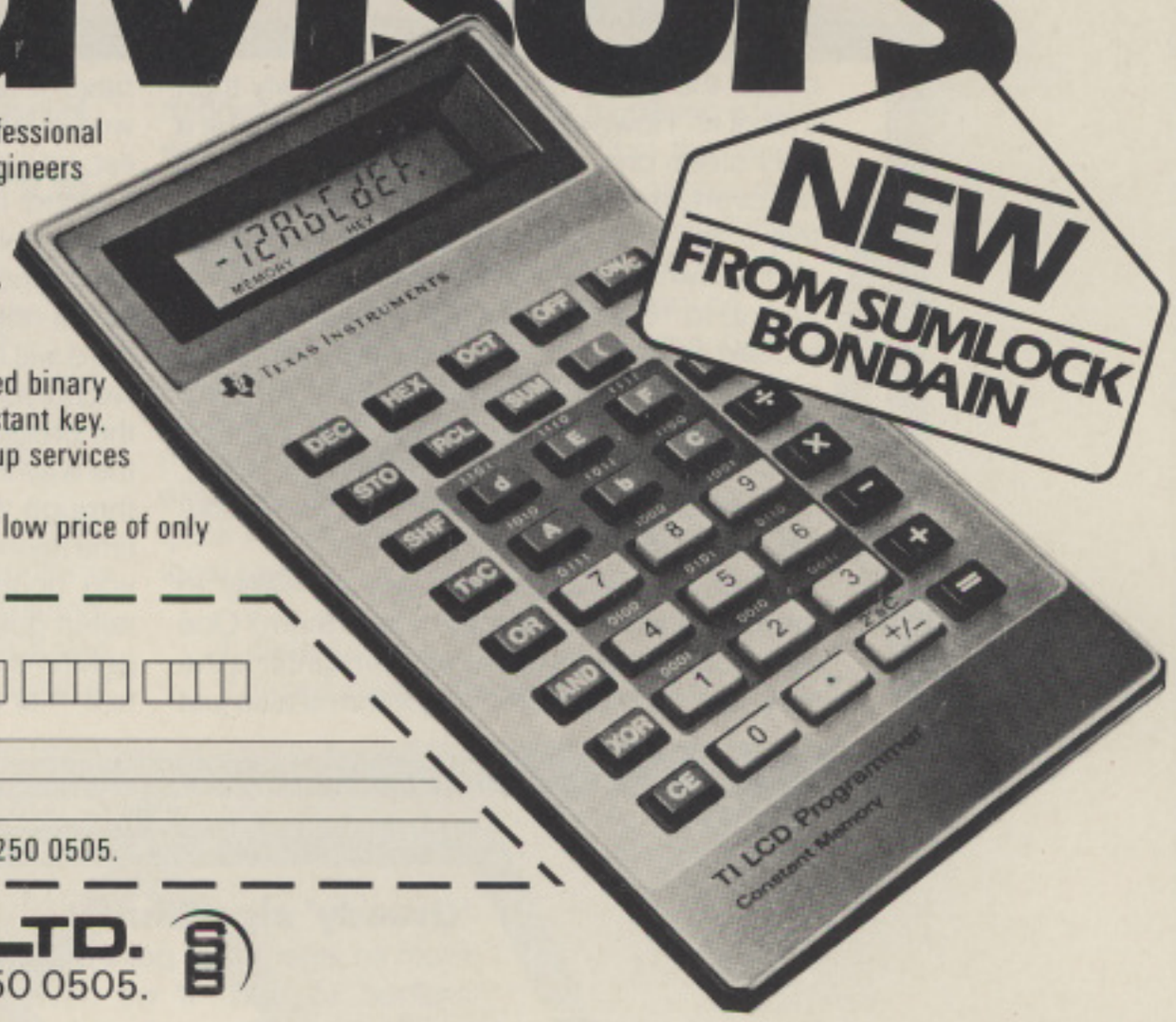

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ALGORITHMS

◀ the V(I) as long as we know that the objects are in the right order. Here is a greedy BASIC program to solve the problem, which assumes that the values in P(I), W(I) and C have already been set up:

```
1000 FOR I=1 TO N
1010 IF W(I) > C THEN I=N GOTO 1040 : REM TEST IF ROOM FOR
                                ALL OF NEXT OBJECT
1020 X(I)=1 : REM PUT OBJECT INTO KNAPSACK
1030 C=C-W(I) : REM DECREMENT REMAINING CAPACITY
1040 NEXT : REM MOVE TO NEXT OBJECT
1050 IF I<N THEN X(I)=C/W(I) : REM PUT IN PART OF NEXT
                                OBJECT
```

The program will put the objects into the array X(I).

Job sequencing

Another similar problem which is maybe a little more applicable to modern life than putting objects into knapsacks (with apologies to Baden-Powell!) is the problem of job sequencing. Here we have a set of n jobs, each of which has to be completed by day D(I) to earn a profit P(I). Each job takes one day to perform, and we only have one machine on which to do the work. Say we have four jobs, with profits, 90, 25, 50, 30 and deadlines 2, 3, 1, 2. The basis of the algorithm is that the next job we do is the one with the largest profit, provided that it can be done by its deadline. We start off by choosing the job with the largest profit, in this case job number 1. The next highest is job 3, but this has a deadline 1, so we must do job 3 first, then job 1. The next highest profit is job 4, but this has a deadline 2, and we are going to be busy for two days doing jobs 1 and 3. The only other job is job 2, which has a deadline of 3, so we can fit it in after the other two jobs. Poor old job 4 is going to be left undone!

There are many other problems, more complicated than these, which can be solved by the greedy method. A typical one is the Shortest Path Problem. You can think of this in terms of a map with a number of towns on it, and a number of routes between them. Given two towns, you have to find the shortest route between the two. Another problem of interest to home computer users, is the order in which to save a number of programs of various lengths on a tape so that the average recovery time is minimised. The answer is that the programs have to be sorted so that the shortest is saved first, then the next shortest, ending with the longest one. It is obvious, but it is not very easy to *prove* that it is so.

Travelling salesman

Perhaps the most famous problem is the Travelling Salesman Problem. A salesman has to visit a number of places in a given area. You have to tell him in which order to make his visits to minimise the time taken. Unlike the knapsack problem which is a selection problem (selecting the object which will give us the highest profit), this is a permutation problem, which will be harder to solve because there are n! different permutations of n objects. This is (as far as a computer is concerned) a very difficult problem. We thought that the bubble sort was slow, taking a time proportional to n^2. The best algorithms for the Travelling Salesman are even worse, so that an algorithm which sorts out a problem for n points in 1 second, 2n points will take 8 seconds, 4n will take 2 minutes and 10n will take over 8 hours!

One way we can improve the time of an algorithm is called 'divide and conquer'. Say we want to search a set for given record. If the items are in a random order, we will have to start at one end and look at each record until we find the one we want. If there are n records, the average number of comparisons will be n/2. However, if the items are sorted into ascending order, like a dictionary or telephone directory, we have access to a much more efficient method, called a Binary Search.

We start by dividing the data into two parts by looking at the middle element. If that is higher than the one we want, we know we can ignore *all* the records in the top half of our set, because they will be higher still. This means the record we want is in the bottom half. We now have a set of n/2 records, which we divide into two in exactly the same way, which narrows down the search to a set of n/4 items and so on. At each stage, we eliminate large numbers of records without even looking at them! A binary search on n items makes logn/log2 comparisons, so if we have 1000 records, we can find the one we want in 10 comparisons, compared with an averge of 500 by the simple method. In fact, in contrast to the bubble sort, the binary search is the fastest known algorithm of its type, and yet it makes quite a small BASIC program:

Binary search program

```
1000 L=1 : H=N
1010 IF L > H THEN 1050
1020 M = INT (L+H)/2
1030 IF X < A(M) THEN H=M-1 :REM CHOOSE BOTTOM HALF
1030 IF X > A(M) THEN H=M+1 :REM CHOOSE TOP HALF
1040 RETURN :REM A(M) IS THE ONE WE WANT!
1050 M=-1 : RETURN :REM ITEM DOES NOT EXIST
```

Divide and conquer

Many sorting algorithms, such as MERGESORT and QUICKSORT use the principle of divide and conquer. Instead of sorting n records, we split them into two sets of n/2 records. Each of these is split into half and so on until we get down to a very small number of records in a large number of sets. We can now sort each set separately (using a sort such as the insertion sort which is very fast for small numbers of items) and then merge the sets together. Merging is an operation which is very quick, so we would rather merge than sort.

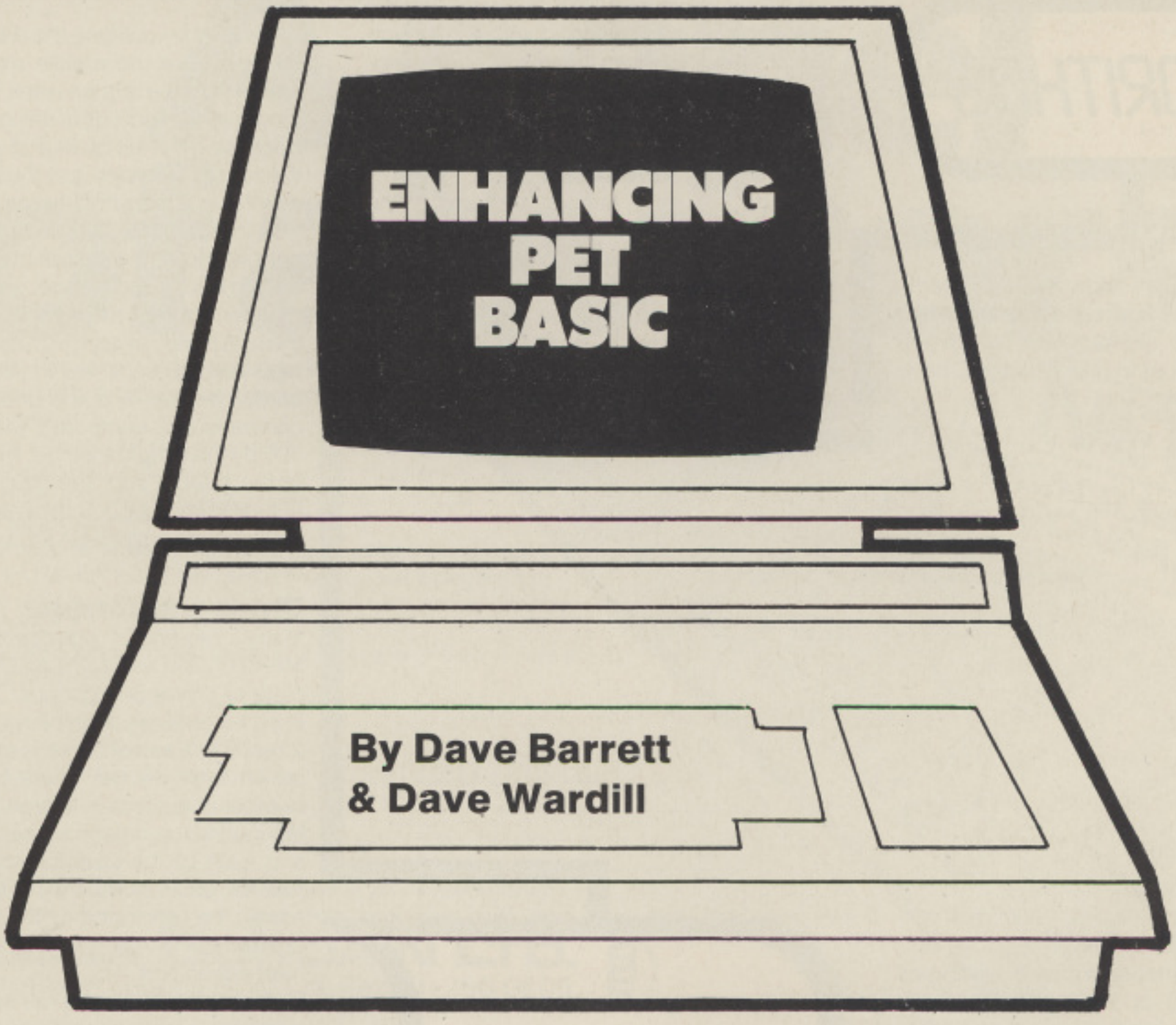
We have looked at a fair sample of the algorithms which have fascinated computer scientists and mathematicians for the past two thousand years. You may be interested to know that there are still many problems for which no efficient algorithm is known, such as the travelling salesman problem. Before we draw a discrete veil over the subject, here are a couple more interesting problems.

The Postage Stamp problem, where we imagine a country which has n denominations of stamps, but only m stamps are allowed on each letter. For example, if n=4 and m=5, then stamps with values 1, 4, 12 and 21 allow postage values 1 to 71. The problem is, for every n and m from 1 upwards, to find the values of the stamps which give the largest range.

The Eight Queens Problem. You have to place 8 queens on a standard 8 by 8 chessboard so that no two attack, that is no two may be on the same row, column or diagonal. This can be expanded to the general case of putting n queens into an n by n square chessboard.

Hopefully this article has whetted a few appetites, aroused a bit of curiosity and also given a few hints on how to produce faster algorithms. Unfortunately, many of the more powerful techniques require certain tools which we have no room for here, such as binary trees and graphs. These are not terribly difficult, so if enough of you write in and request more, maybe the Editor will capitulate and run this as a separate series.

END



Last month, we explained how you could add a collection of new words to your PET. They would be recognised in your program, or as a direct command, with no loss of time or compatibility.

This month, we are going to look at one of the words in more detail. You will be able to add this to your BASIC vocabulary, if you wish, or you can treat it like any other machine code routine and load it into RAM when you need it.

Keyinput

We called the word KEYINP.

The way it works is seen most easily from an example. Suppose you have written a menu-driven program of some sort. On the screen there is a confident list of options, like this:

```
        MENU


BEGIN A NEW FILE
CHANGE A RECORD
FIND A RECORD
READ A FILE
END


PRESS 'B,C,F,R or E' TO CONTINUE
```

So far, so good; but the menu is then probably checked with some awful-looking segment of program like this. (There is no doubt a more efficient way of writing this – but why should we spoil a good example just because of that?)

```
200 GET B$ : IF B$=" " THEN 200
210 P=1
220 IF B$="B" THEN P=2
230 IF B$="C" THEN P=3
240 IF B$="F" THEN P=4
250 IF B$="R" THEN P=5
260 IF B$="E" THEN P=6
270 :
280 ON P GOTO 200,1000,2000,3000,4000,5000
```

All this rigmarole can be replaced with a much simpler routine, using the new word, KEYINP.

```
200 A$="BCFRE"
210 KEYINP A$,B$
220 ON PL% GOTO 1000,2000,3000,4000,5000
```

So, what is it doing? KEYINP has to have three variables associated with it. The first one, A$ in the example, is a string which contains the allowed keypresses.

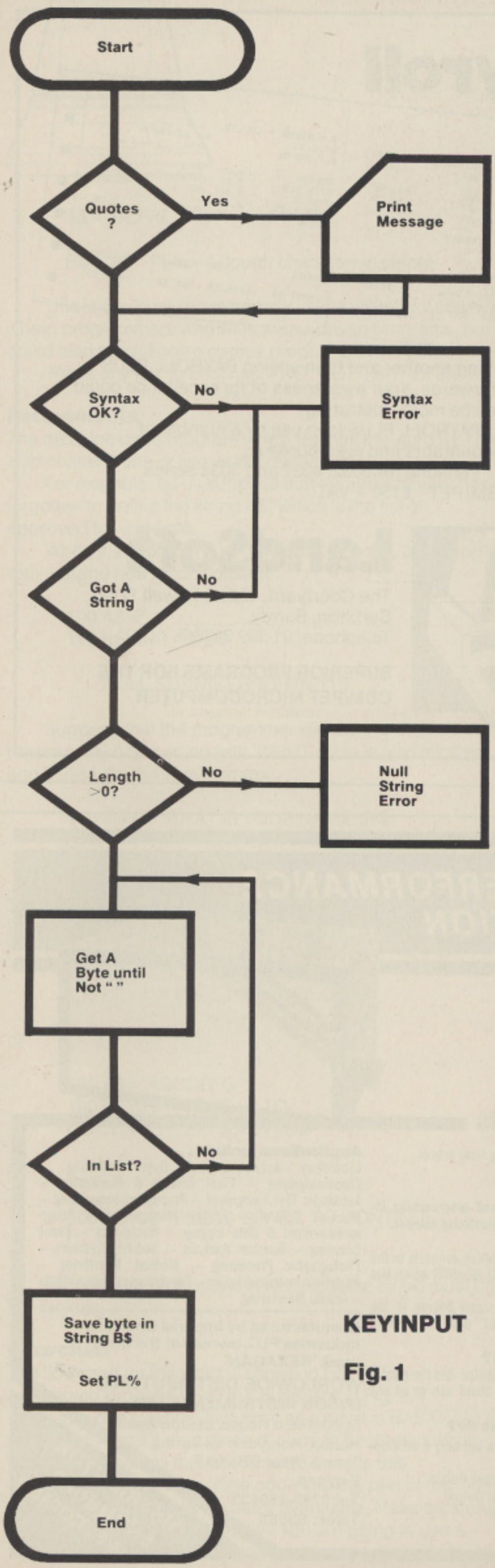
Incidentally, if you want the STOP key to work at this point, you have to include it in the string. That is quite easy to do – as you type the string, press the stop key as one of the allowed keypresses. You will see that it has been accepted as a reverse 'C' appears. This is like getting a reverse heart for 'clear screen' in a print.

The second variable, B$ in the example given above, is a single character variable. After KEYINP has been used, it contains the character of the key which was pressed.

The third variable, PL% is given a number by KEYINP which represents the position of the character in the approved string. If you press the key which is the fourth character in the string A$, then PL% will become equal to 4.

Therefore in our example, if A$="BCFRE" and the letter 'R' is pressed then:

▶

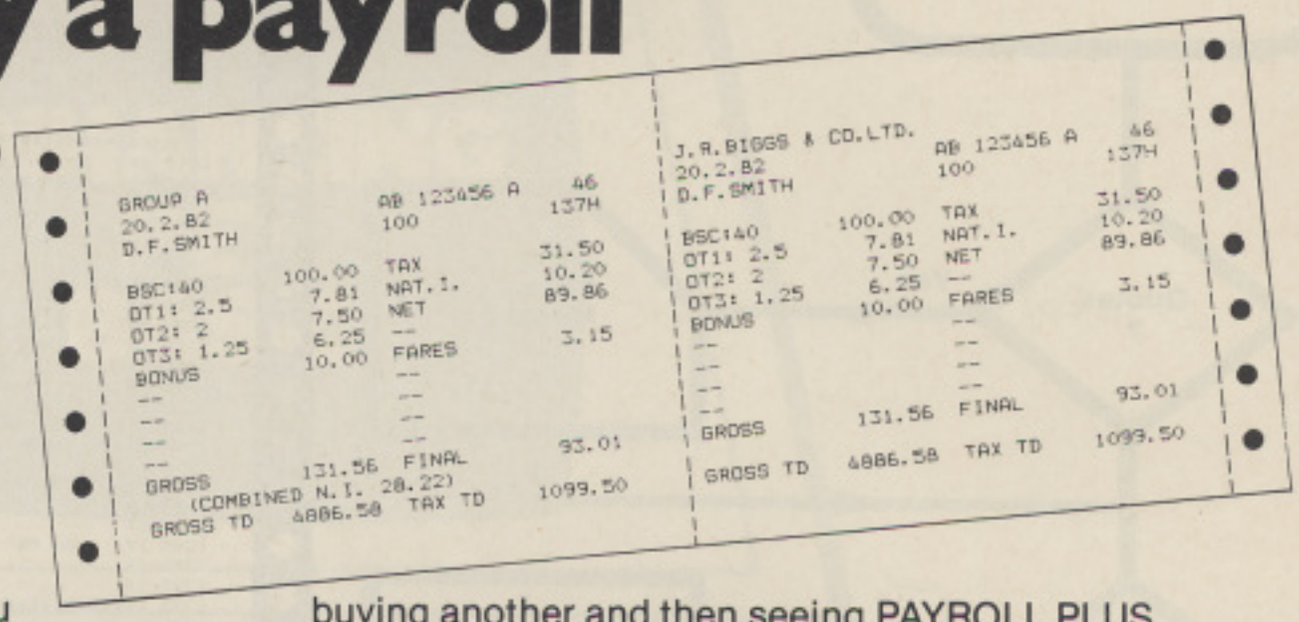


KEYINPUT

Fig. 1

```
1000 ;*************************************************************************
1010 ;*
1020 ;*    GETKEYA$,B$ OR SYS XXXXX,A$,B$
1030 ;*
1040 ;*
1050 ;*    LIST ALL POSSIBLE KEYPRESSES IN A$
1060 ;*
1070 ;*
1080 ;*    'GET' UNTIL ONE OF THOSE LISTED HAS BEEN PRESSED
1090 ;*
1100 ;*
1110 ;*    PUT 'GOT' KEY INTO B$ -IT MUST GO INTO A STRING VARIABLE
1120 ;*
1130 ;*
1140 ;*    AND MAKE AN INTEGER VARIABLE-PL%-EQUAL TO THE POSITION ALONG
1150 ;*
1160 ;*
1170 ;*    THE CHECK STRING WHERE THE MATCH OCCURED
1180 ;*
1190 ;*
1200 ;*    YOU MAY OF COURSE USE ANY VARIABLE NAMES THAT ARE LEGAL
1210 ;*
1220 ;*
1230 ;*************************************************************************
1240 ;
1250 ;
1260 *=$3000
1270 ;
1280 ; BASIC 4
1290 ;
1300 MISMAC =$BD93
1310 DIRECT =$C4CF
1320 STREVA =$BD98
1330 EVAL   =$BEE9
1340 DISCRD =$C7B5
1350 PRTSTR =$BB1D
1360 PRINT  =$E202
1370 COMMA  =$BEF5
1380 PUTVB  =$C12B
1390 ERORIN =$B3ED
1400 CHECK  =$BEF7
1410 RTINE1 =$BC34
1420 RTINE2 =$C187
1430 RTINE3 =$BEB5
1440 GET    =$FFE4          ;SAME
1450 GOTKEY =$0076          ;)
1460 TYPE   =$07            ;)
1470 SEMI   =$3B            ;)
1480 NUMKYS =$9E            ;)
1490 RETURN =$0D            ;)    IN
1500 INTYPE =$0B            ;)
1510 LEN    =$16            ;)
1520 POINT  =$17            ;)
1530 SPARE  =$19            ;)
1540 BUFFER =$0200          ;)       BASIC
1550 INVECT =$40            ;)
1560 CVAR   =$42            ;)
1570 CVARAD =$44            ;)
1580 POINT1 =$46            ;)
1590 BASSVE =$48            ;)            3
1600 BASPNT =$77            ;)
1610 ;
1620 ;
1630 ;AND FOR BASIC 3 THEY WOULD BE
1640 ;
1650 ;
1660 ;
1670 ;
1680 ;
1690 ;MISMAC =$CC9A
1700 ;DIRECT =$D280
1710 ;STREVA =$CC9F
1720 ;EVAL   =$CDEC
1730 ;DISCRD =$D57D
1740 ;PRTSTR =$CA1C
1750 ;PRINT  =$E3D8
1760 ;COMMA  =$CDF8
1770 ;PUTVB  =$CF6D
1780 ;ERORIN =$C377
1790 ;CHECK  =$CDFA
1800 ;RTINE1 =$CB39
1810 ;RTINE2 =$CFC9
1820 ;RTINE3 =$CDB8
1830 ;
1840 ;
1850 ;
1860 ;
1870 ;ASSEMBLED HERE FOR BASIC 4
1880 ;**************************
1890 ;
1900 ;
1910 ;
1920 ERROR2 LDA #<SHORT     ;)SET UP
1930        LDY #>SHORT     ;)       'NULL STRING'
1940        JSR PRTSTR      ;)                      AND PRINT IT
1950        JMP ERORIN      ;)AND WHERE IT OCCURRED
1960        PLA
1970 ERROR1 JMP MISMAC
1980        JSR COMMA       ; START HERE IF NOT INTERFACED TO BASIC
1990        JSR GOTKEY
2000 ;
2010 ;                        MISS THE ABOVE TWO LINES IF INTERFACED TO BASIC
2020 GETKEY CMP #""         ; START HERE IF INTERFACED TO BASIC
2030        BNE CONT
2040        JSR PRE         ;SO WE WANT TO PRINT SOMETHIND FIRST
2050        LDA #RETURN     ;PRINT A RETURN ONLY IF WE HAVE A PRE PRINT
2060        JSR PRINT
2070 CONT   JSR DIRECT      ;CHECK THAT WE ARE NOT IN DIRECT MODE
2080        JSR GTNDIS      ;FIND THE CHECK STRING
2090        LDA TYPE
2100        BEQ ERROR1      ;WE HAVE BEEN GIVEN A NUMERIC SO JUMP TO MISMATCH
2110        LDY #$02        ;)SAVE
2120 AG     LDA ($61),Y     ;)     POINTERS
2130        STA $0016,Y     ;)              AND LENGTH
2140        DEY             ;)                     OF THE
2150        BPL AG          ;)                           'CHECK STRING'
2160        LDA LEN
2170        BEQ ERROR2      ;IF ZERO THEN WE HAVE A 'NULL STRING ERROR'
2180        JSR COMMA
2190        LDA #$00
2200        LDX #$01
2210        LDY #$02
2220        STA BUFFER+1    ;ONLY 1 CHR SO END WITH A ZERO BYTE
2230        STA NUMKYS      ;SET KEYBD BUFFER TO ZERO
2240        LDA #$40        ;TELL THE MACHINE WE ARE DOING A 'GET'
2250        STA INTYPE
2260        STX INVECT
2270        STY INVECT+1
2280        JSR PUTVB       ;VARIABLE TO RECEIVE KEYPRESSED
2290        PHA             ;SAVE IT
2300        LDA TYPE
2310        BEQ ERROR1-1    ;AGAIN IF ZERO WE HAVE A NUMERIC THEREFORE MISMATCH
2320        PLA
```

How to buy a payroll program...



First, go to your CBM/PET dealer and ask to see at least two different payrolls. Second, make sure that one of those you see is the LANDSOFT 'PAYROLL PLUS'.

We are serious when we say you should see more than one. That way you are more likely to find the one most suited to your needs. However good PAYROLL PLUS is, there are certain things it won't do that other payrolls will — and vice versa.

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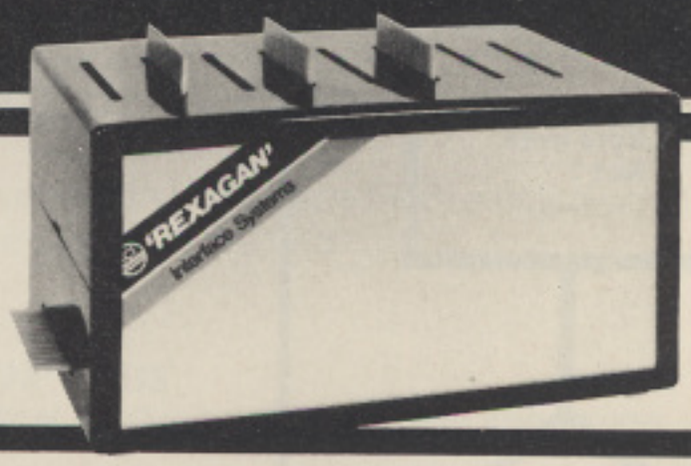

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can do several jobs at once, collect data, send control signals, monitor power supply, sound alarm signals, etc.

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DISTRIBUTOR ENQUIRIES WELCOMED

A$="BCFRE"

B$="R" PL%=4 (fourth character in string)

This is obviously an extremely useful word. Not only will it help programmers who write menu-driven programs, but it could also revolutionise games programs of the genre:

'Press any key to continue – NO, NOT THAT ONE!'

Refinements

The machine code program which defines the word KEYINP also contains one or two useful refinements.

For example, let us suppose that the programmer has forgotten to define the string A$, which is the list of approved key presses.

When the program flow reaches that point, it will stop with a brand new error message.

```
100 A$=" "
110 KEYINP A$, B$

    NULL STRING ERROR IN 110
```

Suppose that the programmer wishes to include a message, like he can do with 'INPUT'. This is also allowed, and it uses the the same syntax.

```
100 INPUT"WHAT IS YOUR NAME";N$
or
100 KEYINP"PICK A LETTER FROM 'BCFRE'";A$,B$
```

Typical examples

Some typical examples of its use would include:

```
120 A$="ABCDEFG"
130 KEYINP"PRESS A NOTE";A$,B$
```

or

```
180 A$="ABCDEFG"
190 KEYINP"PRESS 'A' TO
CONTINUE";LEFT$(A$,1),B$
```

or

```
500 KEYINP"PRESS 'SPACE' TO CONTINUE";
(" "),B$
```

Here, if a variable name is not used, the string must be in brackets.

Flowchart

The flowchart for the word is shown in Fig. 1. The assembled program and HEX dump are in Fig. 2.

If you don't want to include it as a word in BASIC, but just want to keep it as a piece of code to be loaded when you need it, then all that needs to be done is this.

Type in the Hex machine code into the part of the memory where you plan to use it eventually. Make a careful note of where the routine starts if you are going to use a 'SYS' call – it is 15 bytes into that routine, as you will see

```
2330 ;
2340 ;
2350        STA POINT1      ;)SETUP
2360        STY POINT1+1    ;)
2370        LDA BASPNT      ;)
2380        LDY BASPNT+1    ;)
2390        STA BASSVE      ;)
2400        STY BASSVE+1    ;)
2410        LDX INVECT      ;)
2420        LDY INVECT+1    ;)
2430        STX BASPNT      ;)
2440        STY BASPNT+1    ;)
2450 AG1    JSR GET         ;GET A KEY PRESS
2460        BEQ AG1         ;NO KEY PRESSED SO DO AGAIN
2470        LDY LEN         ;LENGTH OF CHECK STRING
2480        DEY
2490 AG2    CMP (POINT),Y   ;IS KEY PRESSED IN OUR LIST OF ALLOWED CHRS
2500        BEQ GOTYA       ;YES SO GO AND DO IT
2510        DEY
2520        BPL AG2         ;MORE TO CHECK
2530        BMI AG1         ;NOT IN LIST SO GET AGAIN
2540 GOTYA  STY SPARE       ;SAVE Y FOR PLX
2550        JSR RTINE1
2560        LDA £*DO        ;P
2570        STA CVAR
2580        LDA £*CC        ;LX
2590        STA CVAR+1
2600        JSR RTINE2      ;)MAKE
2610        LDY £*00        ;)   VARIABLE
2620        TYA             ;)          'PLX'
2630        STA (CVARAD),Y  ;)              EQUAL
2640        INY             ;)
2650        INC SPARE       ;)                  TO THE
2660        LDA SPARE       ;)                      POSITION
2670        STA (CVARAD),Y  ;)                          OF CHR
2680        RTS             ;)                              ON CHECK STR
2690 SHORT  .BYTE 'NULL STRING',00
2700 PRE    JSR RTINE3      ; SET UP A PRINT BEFORE WE START
2710        LDA £SEMI       ;MUST BE FOLLOWED BY A SEMI COLON
2720        JSR CHECK       ;SYNTAX - ERROR IF NOT PRESENT
2730        JMP PRTSTR+3
2740 ;
2750 GTNDIS CMP £'(         ;INSIDE BRACKETS ?
2760        BNE ROUND       ;OK THEN EVAL WITHOUT THE BRACKET
2770        JSR EVAL        ;FIND OUT WHATS INSIDE THE BRACKETS
2780        JMP DISCRD      ;CLEAR UP
2790 ROUND  JSR STREVA      ;FIND THE STRING
2800        JMP DISCRD      ;CLEAR UP
2810 ;
2820 ;
2830 ;
2840 .END
```

```
C*
     PC   IRQ   SR AC XR YR SP
.;   B780 E455 2C 34 3A 9D F6
.
.:   3000 A9 99 A0 30 20 1D BB 4C
.:   3008 ED B3 68 4C 93 BD 20 F5
.:   3010 BE 20 76 00 C9 22 D0 08
.:   3018 20 A5 30 A9 0D 20 02 E2
.:   3020 20 CF C4 20 B0 30 A5 07
.:   3028 F0 E1 A0 02 B1 61 99 16
.:   3030 00 88 10 F8 A5 16 F0 C8
.:   3038 20 F5 BE A9 00 A2 01 A0
.:   3040 02 8D 01 02 85 9E A9 40
.:   3048 85 0B 86 40 84 41 20 2B
.:   3050 C1 48 A5 07 F0 B4 68 85
.:   3058 46 84 47 A5 77 A4 78 85
.:   3060 48 84 49 A6 40 A4 41 86
.:   3068 77 84 78 20 E4 FF F0 FB
.:   3070 A4 16 88 D1 17 F0 05 88
.:   3078 10 F9 30 EF 84 19 20 34
.:   3080 BC A9 D0 85 42 A9 CC 85
.:   3088 43 20 87 C1 A0 00 98 91
.:   3090 44 C8 E6 19 A5 19 91 44
.:   3098 60 4E 55 4C 4C 20 53 54
.:   30A0 52 49 4E 47 00 20 B5 BE
.:   30A8 A9 3B 20 F7 BE 4C 20 BB
.:   30B0 C9 28 D0 06 20 E9 BE 4C
.:   30B8 B5 C7 20 98 BD 4C B5 C7
.:   30C0 AA AA AA AA AA AA AA AA
.
.
READY.
```

▶ 97

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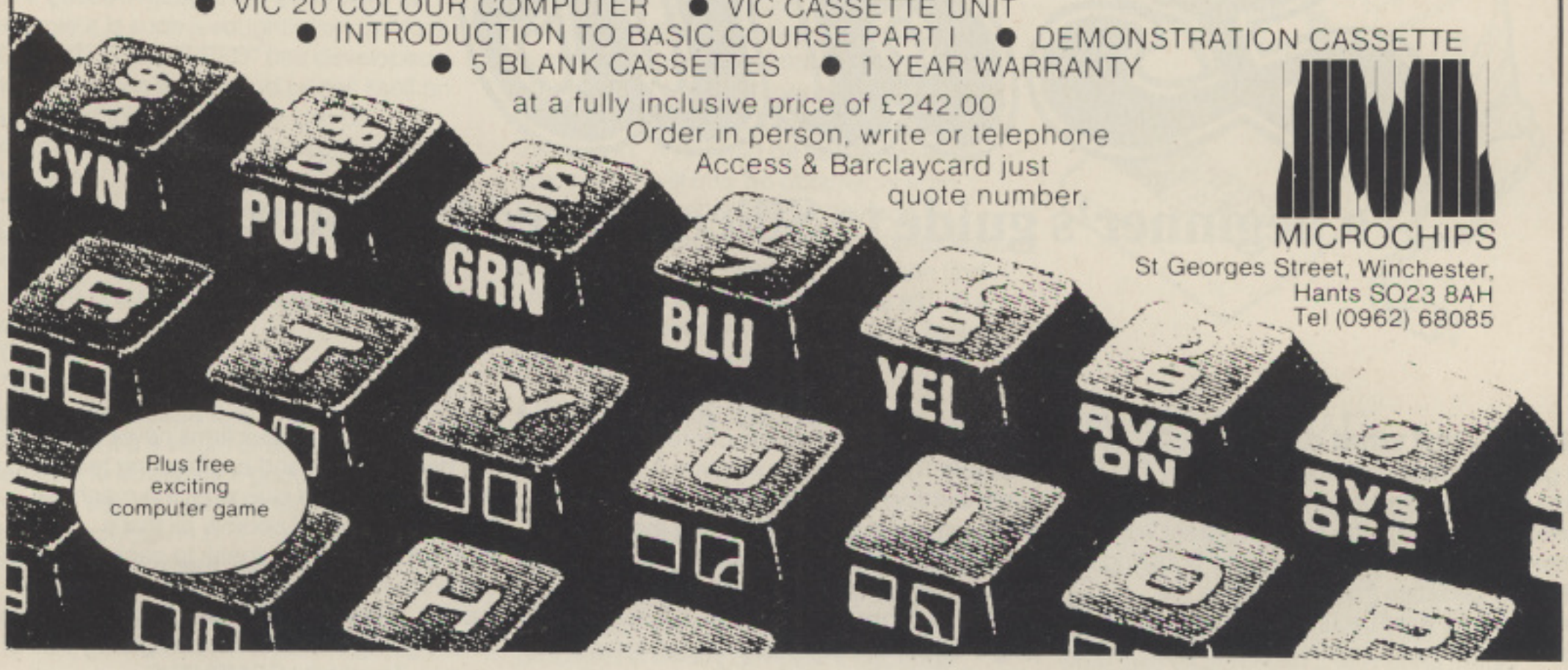

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Jungle Law

By Humphrey Walwyn

– a beginner's guide to Silicon based life forms

Great – but what does it do?

A good question and one which every first time buyer of a microcomputer is well justified in asking. The shop assistant will immediately respond with a mind boggling list of possibilities from 'controlling the environment within your tropical fish tank' to 'printing out your Christmas cards and addresses'. Everything he says will – within some limits – be possible but often not practical. You can already control your fish with a thermostat (price three quid) and which of your friends would like to receive a computer printed envelope during the festive season? Christmas cheer in gas bill print does not make for personal greetings!

After five minutes of listening spell bound to the enthusiastic outpourings, you will be more confused then ever before. The best question to ask is the more obtuse one ... 'Yes, but what *doesn't* it do?' This will normally result in a meaningful silence. The thought has probably never occurred to the shop assistant that his golden dream machine may not be able to do everything. It's not his fault. With the plethora of dazzling machinery available, the claims by each manufacturer for the brilliance of their product are designed to catch the eye of the purchaser and, sometimes, to numb him into submission. When the microcomputer boom hit the United Kingdom five years ago, there weren't too many machines about so there wasn't too much confusion about which machine to buy. There was, however, total confusion about what to do with it once you'd got it home. There still is. And now that there are so many machines available, the confusion is all the greater. Which is why this magazine spends much time trying to clear a path through the jungle.

Strange encounters

You'll have read elsewhere in these pages some very sound advice on what or why to buy and there are always reviews of the latest silicon beasts to emerge from the forest....but some of you will no doubt still feel lost by the sheer range of products available. The computer jungle is full of some startling creatures and, because of the commercial pressures facing the manufacturers, the jungle is also full of mis-information, industrial confusion and predators eager for your trade. It is also a jungle where evolution runs at high speed. Indeed, in the time you've taken to read this article, Science will have advanced by a couple of minutes and those couple of minutes in a technical laboratory may have led to a new and dramatic technological breakthrough! Yesterday's computer may already be a dodo.

There is also something very sobering to bear in mind about the speed of the evolutionary process. *Every* machine in the shop window is technically out of date. The next generation is being born on the industrial test-bench right now.

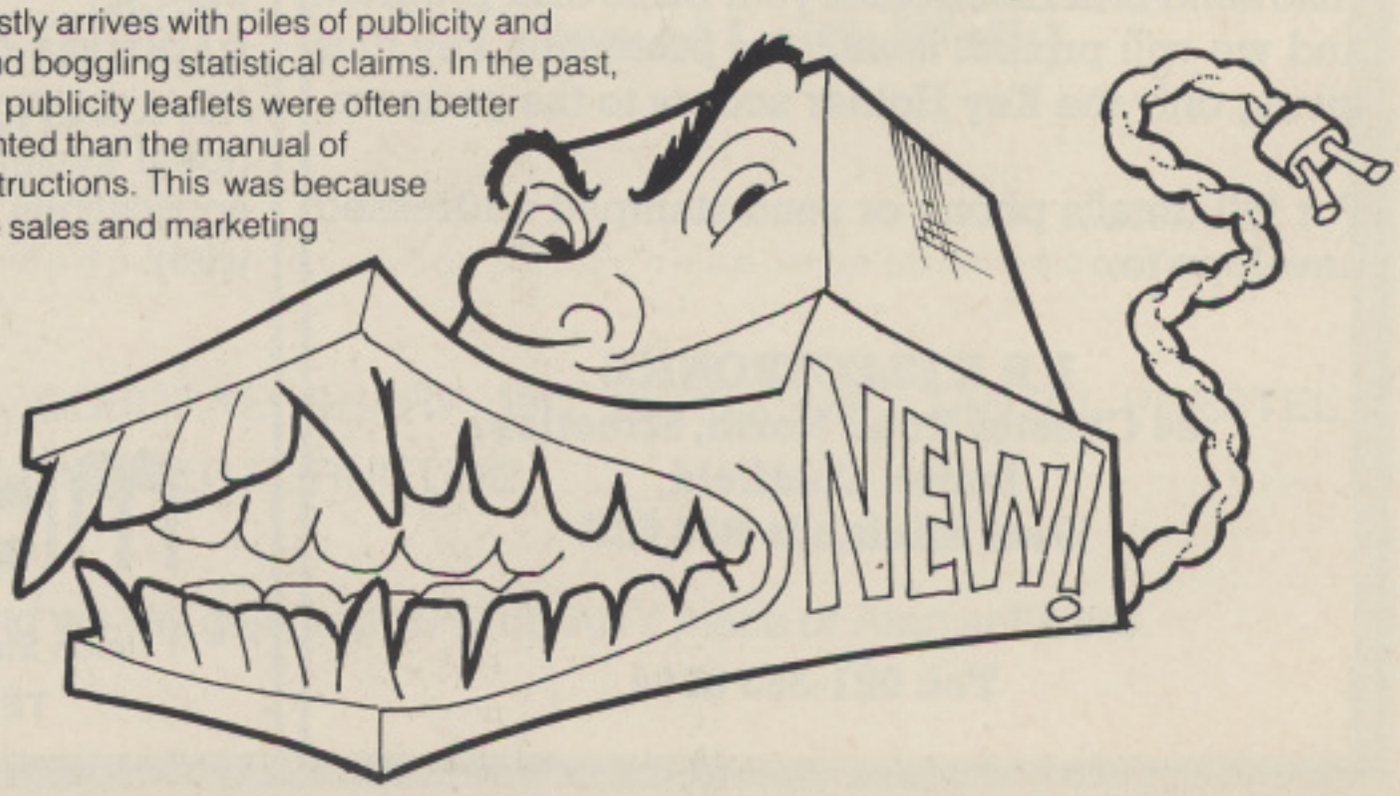
So what to do? Well, you can always take a guided tour around the jungle. When expecting a series of strange encounters, you should always be prepared. Here's a handy survival guide: don't venture out alone without it.

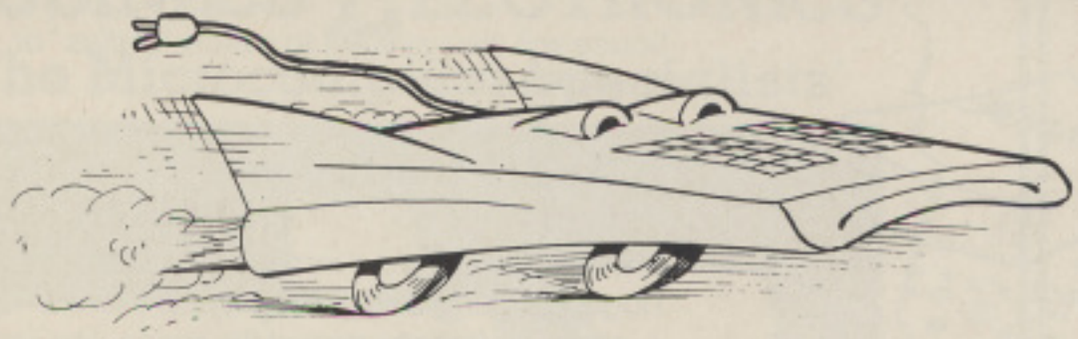
COMPUTUS AGRESSIVUS

Mostly arrives with piles of publicity and mind boggling statistical claims. In the past, the publicity leaflets were often better printed than the manual of instructions. This was because the sales and marketing departments in various firms never spoke to the development and engineering teams so they didn't have a clue what the machine could really do. Of course, all that's changed now. They speak to each other but since the marketing people aren't computer trained, they listen but still don't have a clue what's going on. Well, not completely true of course. Thankfully COMPUTUS AGRESSIVUS is becoming extinct but watch out because they occasionally fall out of the trees and gobble you up. Its hallmarks are the exciting looks, flashy finish and 'very new' tag. Remember that the reason it is exciting is because it *is* new! A 'sheep in wolf's clothing' will not only empty your wallet; it may leave you too confused to progress beyond discovering where the mains switch is.

COMPUTUS "HI-SPEED" TEKNOLOGIUS

A modern descendant of COMPUTUS AGRESSIVUS. It is, by reason of its 'HI-SPEED' name, quite a rare creature. The wave of publicity material and adverts announcing its imminent arrival are somewhat in advance of reality. When you read about this beast, it seems to be the





answer to many of your problems – excellent specifications, amazing facilities and a nice low price. But can you find it? No, no one's seen it. The reason is that the demand for it somewhat exceeds supply. In some cases it hasn't even been *born* yet. Because it is such a sought after creature, COMPUTUS "HI-SPEED" has developed unique evasion tactics and prides itself on being hard to track down. It can be recognised by the following replies to your enquiries....

"Oh no Sir, we're still waiting for it. We had one in last week but the boss took it home."

Or...

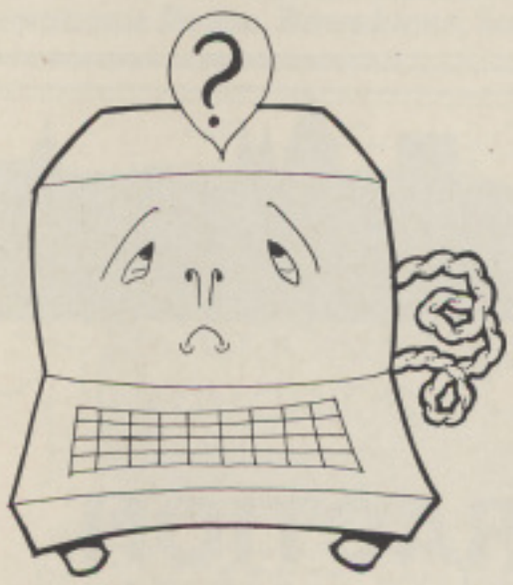
(laugh) "You must be joking, Sir. There's a six month waiting list!"

Or...

"No, Sir, but I've got a friend at the factory and for a small extra fee..."

Although it's a victim of advance publicity, this beast is obviously a good buy. If everyone seems to want it too, then it must be pretty special. N.B. If YOU can find one, do let me know where you got it from...

COMPUTUS INCOGNITUS



If you tell anyone else that you have one of these, the reaction will probably be: "What make? Sorry, never heard of it." This needn't matter since it might give you a psychological advantage NOT to be part of the crowd. You can also impress your friends by claiming vast powers for the beast since no one will be able to know anything about it to argue with you. However, with the rapidity of current commercial pressures, the company that made it may well have gone into liquidation. If no one's heard of it then that's probably the reason. This could be bad news since spare parts will only be obtainable from Borneo every second Thursday and software for the creature will be non-existant. Friendly and no doubt fun – if you can find any instructions to make it work at all – but not really a sound investment particularly if you want to add things to it later.

COMPUTUS SECOND HANDUS

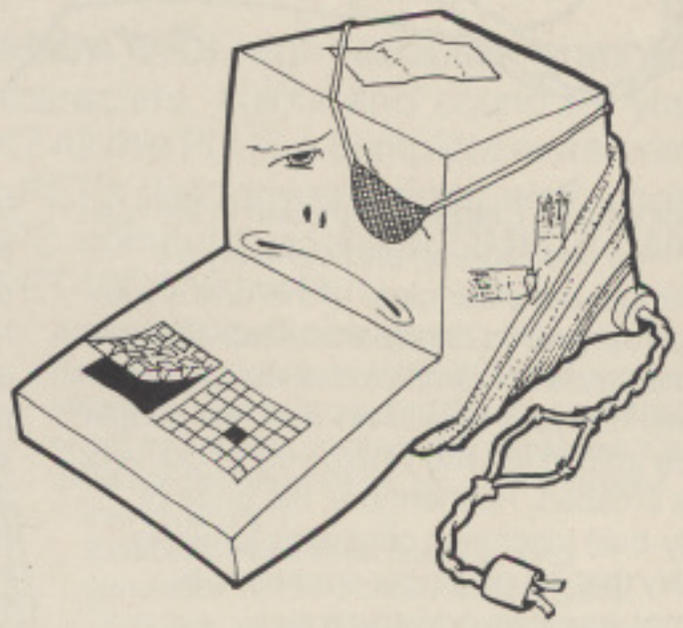
Also known as COMPUTUS PARTEXCHANJUS. This is a growing breed for obvious reasons. You can find them at the back of shops and in all the magazine small ads. Like a secondhand anything, the problems are fairly obvious. It depends what has happened to the thing before it got to you. If it has been well treated then you should suffer no great loss. The best secondhand machine to buy would seem to be the one in the following small ad...

"For sale, XXX 999 for $100.00. Owner can't get to grips with it. Take $50.00"

This means that the machine has been sitting idle for a month or two while the owner despaired of a reckless purchase.

The disadvantages are that there is no guarantee, the machine is definitely out of date and the owner's cat might have done something awful on it. If it is like COMPUTUS INCOGNITUS, then the problems of spare parts and 'add-ons' will apply. Software might only be available from a P.O. Box in California which was last operational in 1978. Also check the price carefully. You might be able to get the same facilities on a new machine for the same amount of money.

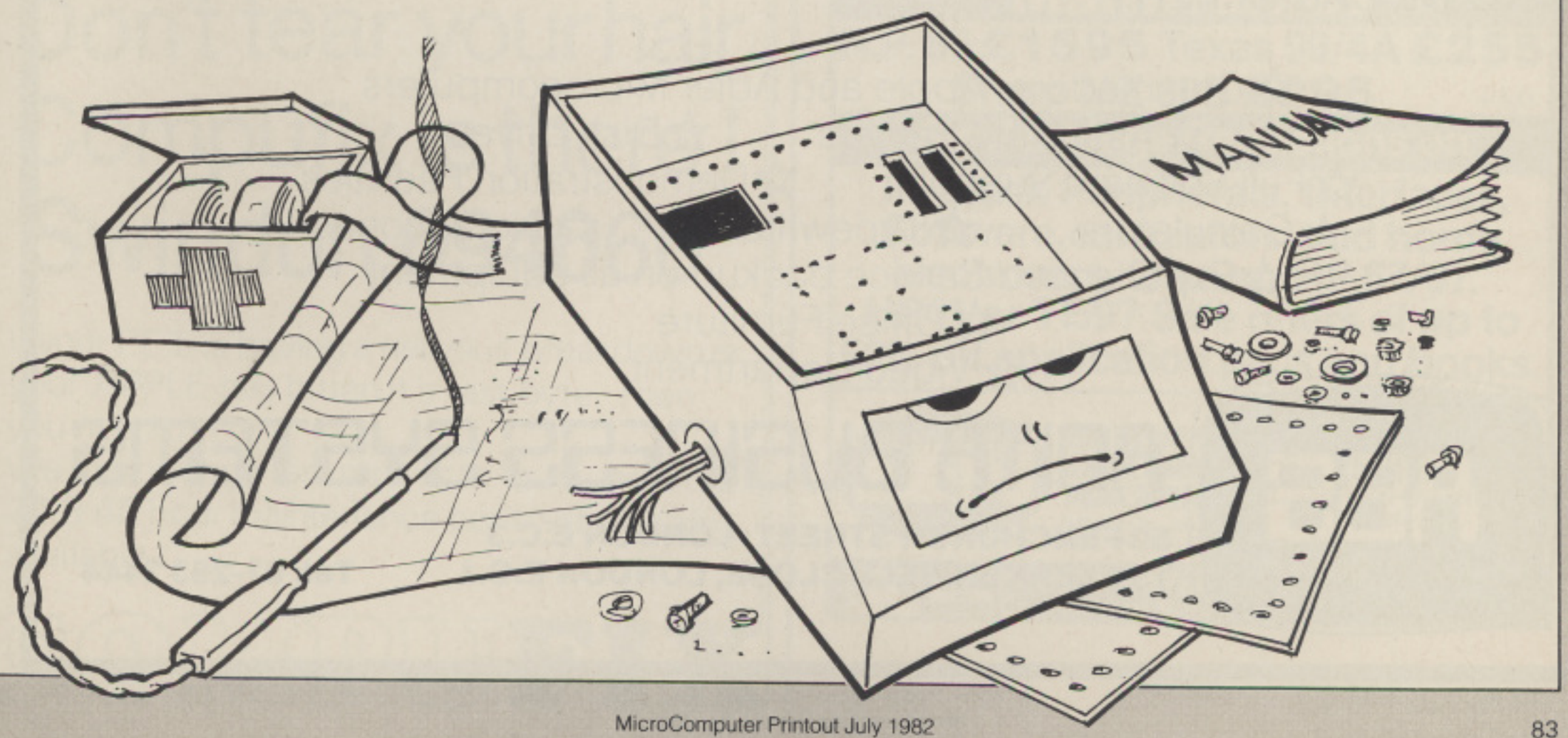
The best clue to the machine's wear and tear is to examine the keyboard. If the letters and numbers are faint and worn then someone's been giving it quite a bashing!

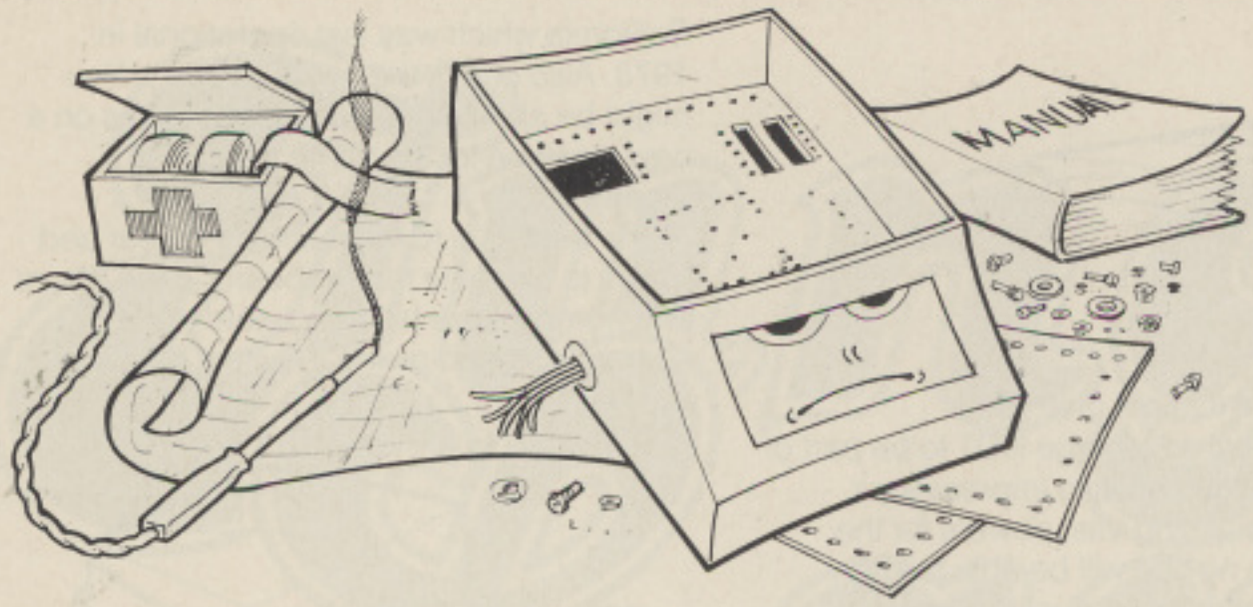


COMPUTUS 'DO IT YOURSELFUS'

These have been around for some years and, at one time, were the only way to get into amateur computing at all. People who build their own systems either from kits or from bits and chips tend to be very proud of what they've achieved – and quite rightly too. The very idea of wielding a soldering iron anywhere near high technology chips is – to me – quite terrifying so I admire their bravery as well as their skills. Proud of their work they may be but they might not be so proud of their machine's achievements. COMPUTUS 'DO IT YOURSELFUS' is usually pretty limited in its scope since the really advanced computers of today don't normally lend themselves to home construction.

Although some kits are surprisingly simple to build, others may be too complex for the average constructor even to look at. Lines, wires, connections and boards can make the circuit diagram about as ▸





meaningful as Clapham Junction in the rush hour. Fun (well sort of) and certainly a challenge, but stear clear of this one if you value your health, sanity and sleep. Today's technology is so complex that the slightest slip will ruin your work. And very few people will be able to tell you where you've got your wires crossed. Furthermore, the price of ready-built machines continues to fall so quickly that it's no longer economic to attempt your own construction.

A definite NO – unless you're involved in educational research or have masochistic leanings.

General Classification of Silicon Based Fauna and Flora

There are two basic types of Silicon life forms. One is designated "SEPARATI UNITI" and the other is "ALLTOGETHER IN ONE BOXUS". Most modern breeds belong to the former where the creature's heart is contained within a keyboard unit and all the rest of the bits (cassettes, TV, disks, etc.) are attached by umbilical cords. There is no particular advantage about either type – it all depends what you are going to use the thing for. You should bear in mind the following practical considerations however....

(a) It is easier to carry the beast if it is all in one box.

(b) The more connections there are, the more your home will resemble Spaghetti Junction.

(c) Separate units are more flexible since you may already possess some of the units, and not wish to pay for another cassette deck or display screen.

(d) You WILL need two TVs. Whenever YOU want to compute things, the rest of the house will always want to watch *"Dallas"* or *"Top of the Pops"*.

...And in conclusion...

Many of the rules governing the purchase of dogs, cats and budgies also apply to the purchase of silicon based life forms. Having decided to buy *something*, it's purely a matter of choice of breed. If you're not really sure you really want anything but would like to dabble a bit, then don't buy a tropical angel fish. Get a goldfish which will be cheap and cheerful. If you get fed up with it, your friends will be happy to take it off you but they won't be geared to take more exotic creatures.

If you are aware of some of the possibilities your purchase will give you, then don't invest in something too small to do the job. If you really want a guard dog, then don't get a Chihuahua. You'll regret it later.

Lastly, if there is one general rule I would offer it is to go for a popular breed. Exotic and unusual creatures require specialist training. The more animal of a particular type there are, the more owners clubs and advice there will be. Food (software) will be plentiful and the breed is less likely to die out owing to lack of interest.

Above all, treat it kindly and you'll have a lasting relationship!

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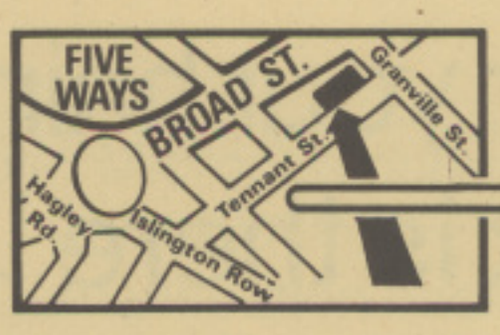

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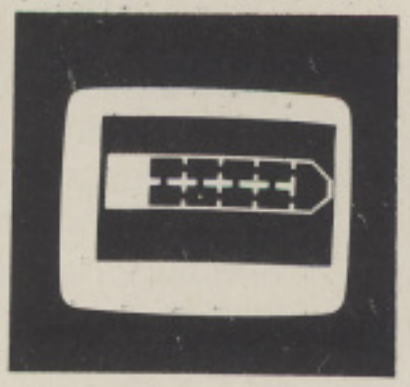

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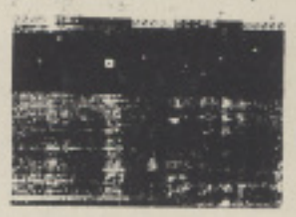
CUBE Rubik Cube simulator, with lots of functions including 'Backstep'.
SECRET MESSAGES This message coding program is very txlp qexi jf.
MARTIAN CRICKET A simple but addictive game (totally unlike Earth cricket) in machine code. The speed is variable, and its top speed is very fast.
Cassette 3 costs £5.

CASSETTE 4

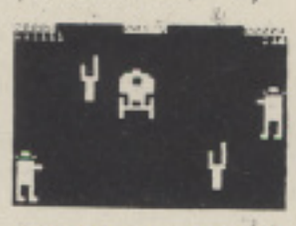
7 games for 16k

ZX SCRAMBLE (machine code)



Bomb and shoot your way through the fortified caves.

GUNFIGHT (machine code)



INVADERS (machine code)

GALAXY INVADERS (machine code). Fleets of swooping and diving alien craft.
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TOMMY'S TIPS

This month I thought I'd take the opportunity to catch up on some of those heavy technical queries which you long-standing PET owners insist on bombarding me with. The Editor, who doesn't qualify for the label 'long-standing' (largely on account of his particularly potent homebrew), tells me that I mustn't favour PET owners, so I promise a good spread of general queries next month. After all – it is the time of the PET Show....

By the way, I shall be at the forthcoming PET Show, buzzing around, poking my nose into other people's business. If any of you intend coming to the show, why not look me up. I would be glad to buy a drink for any of my faithful readers. Oh dear, the Editor has just told me that this issue will not appear until just *after* the show. What a shame....

Aide memoire

Dear Tommy,
I store data by POKEing it directly into the free memory area of my PET. I would like to be able to SAVE to, and LOAD from my cassette unit under program control. I have found this very difficult to do. In fact, despite disassembling most of the PET's operating system (and understanding precious little of it) I have not yet fathomed out a method which does not cause it either to crash or jump into the Monitor.
T. Hatchett.

Try this little routine:

```
35 POKE512,PEEK(42):POKE513,PEEK(43)
40 POKE42,52:POKE43,4
50 POKE40,32:POKE41,4:SAVE"TEST":POKE40,1:POKE41,4
60 POKE42,PEEK(512):POKE43,PEEK(513)
```

I suppose you would like an explanation of how this works? I wish I were a magician so that I could just pull programs full of mysterious PEEKs and POKEs out of a top hat without people saying, "Yes, but how does it work?" It is in fact a lot easier once the method has been pointed out.

When you LOAD a program from tape or disk in the middle of another program, it is loaded back into the part of memory from which it was saved, and none of BASIC's pointers are altered. Our problem is how to SAVE the area of memory in the first place. In your case we are using LOAD and SAVE to store data rather than a program, but that does not matter. When you give a SAVE command, BASIC saves the area of memory defined by a 'start of program' pointer, locations 40 and 41, and an 'end of program' pointer, 42 and 43. So to save an arbitrary area of memory, we need to save these two pointers, set them to point to the memory area, perform a SAVE, and then restore the original pointer values. In fact, the start of program pointer in 40 and 41 is always 1025, so we do not have to save this. Line 35 saves the end of program pointer, and line 40 sets it to the end of the memory area to be saved. Line 50 sets the start of program pointer to the start of the memory area, performs a SAVE and restores the start of program pointer. Line 60 then restores the original end of program pointer and the program will then continue quite happily. To load the saved data again you can just say:

```
120 LOAD"TEST"
```

and the data will reappear in its old location just like magic. One thing you must be careful not to do is to try to use variables in between lines 35 and 60. In other words, the size and position of the data area are fixed.

TIM Tip

Dear Tommy,
I have come across references to the 'TIM' monitor in new ROM PETs which helps with machine language programming. Could you tell me where I could find information on the TIM monitor?
P.R. Moyes

I am afraid that TIM isn't much use for serious assembler programming. All the information on TIM you are likely to need is in the Commodore manual in the chapter on Machine Language programming. The only facilities the monitor possesses are to display and alter memory locations and the 6502 registers, load and save programs, execute an assembler program and return to BASIC. If you want to do any serious work in the line, Commodore do an Assembler Development System which is much more powerful.

Wait for it ....

Dear Tommy,
I would like your magazine to run an article on the WAIT statement. The manual for my machine is not very clear on its usage. The only WAIT statement I have come across so far is WAIT 59410,4,4 which waits for the space key before continuing. I have used this statement in a program which displays pages of text, waiting for the space key after each one. Sometimes a page or more is missed out. Is this because of key bounce, and if so, how can I prevent it?
M. Pritchett

The WAIT statement is intended to be used to handle I/O operations, and it tests the status of individual bits in a memory location, normally an I/O port. In order to find out how the WAIT statement works, it is necessary to understand the logical operators AND and EOR. A good explanation can be found in the series: "Hardware – how it works"

The format of the WAIT statement is WAIT I,J,K. I is the memory location to be tested, and J and K are values between 0 and 255 to be used in the test. What the WAIT statement does is to read the value of the memory location I, performs an exclusive–OR with the value of J, then performs an AND between the result and K. If the result is non-zero, then BASIC continues, otherwise it repeats the test. In the case you gave, the space bar appears as bit 2 in location 59410, so if the space key is pressed, that bit in 59410 becomes 0. When exclusive–ORed with the 1 in bit 2 of the number 4, we get a 1 in bit 2 of the result. When this is ANDed with 4 (to cut out all the other bits in the word which will also be 1), we get 4, a non-zero result, so BASIC carries on. If the space key is not pressed, bit 2 of 59410 contains a 1, which when exclusive-ORed with the bit from the number 4 gives zero. Zero ANDed with anything gives zero, so the WAIT statement waits:

	Space Pressed	*Space not pressed
Contents of 59410	11111011	11111111
EOR with 4	00000100	00000100
Result	11111111	11111011
AND with 4	00000100	00000100
	00000100 continue	00000000 wait

That's the theory out of the way. I personally do not like the

use of the WAIT statement to test for the space key. What is wrong with this:

```
100 GET A$ : IF A$ = "    " THEN 100
```

WAIT 59410,4,4 does not work on the 8000 PET, does not filter contact bounce (as you suggest), cannot be broken out of by the STOP key (which may not be a problem when a program is installed, but is a nuisance when you're testing) and last but not least it is harder to understand. Having said all that though, I do not think that contact bounce is likely to be affecting your particular program, because by the time you have displayed a page of data, any contact bounce will have died down, and also, you would see the data flash on the screen before being overwritten by the next page, although it is just possible that this is the problem if you are only printing a couple of lines on the screen. On the other hand there are many situations where contact bounce could cause problems, and in these cases the use of GET is a must.

Nasty Little Bug

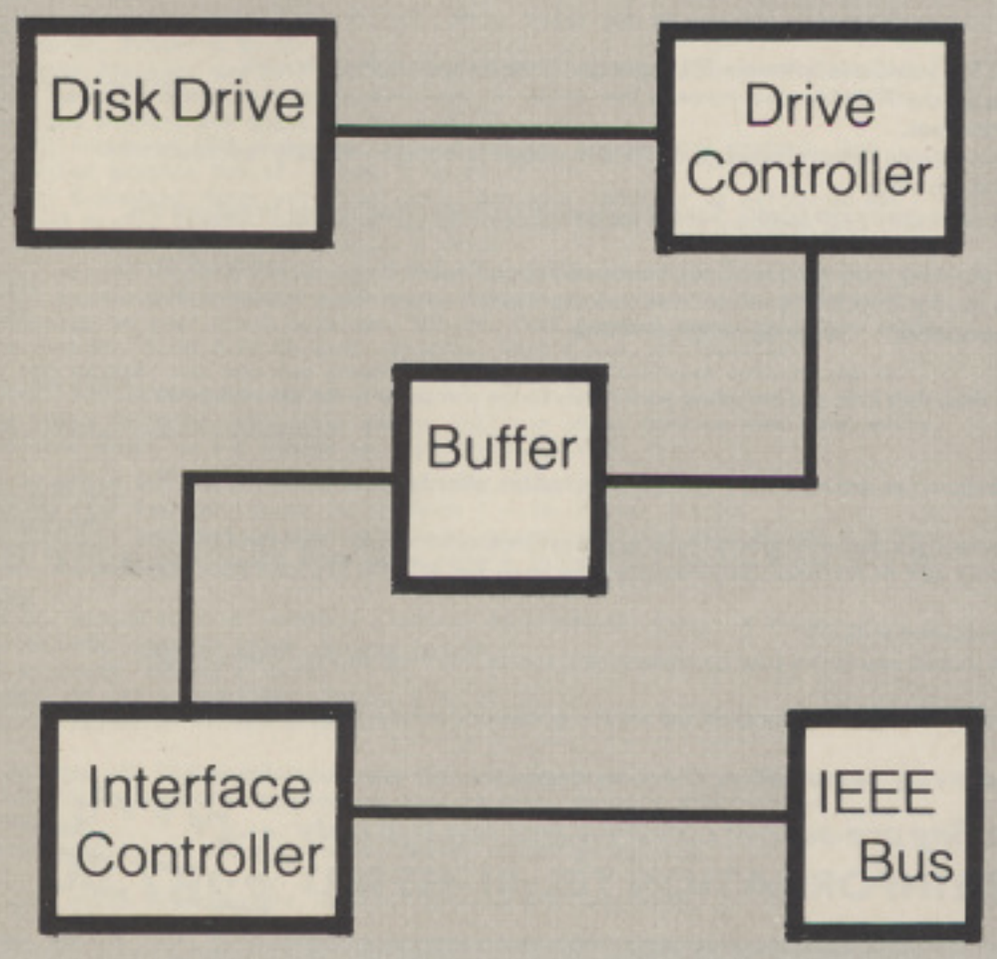
Dear Tommy,
I am writing to ask if you can help me out with what I see as a nasty little bug lurking about in the PET computer.

I am a little perplexed that whilst, for instance, directly dumping on the printer information held in the form of a sequential file on disk, the disk stops revolving for about 30 seconds, and then decides to continue as if nothing has happened.

Also the computer 'freezes' whilst against printing to the printer directly from an array in memory. I have noticed, however, that if one uses LEFT$ in association with formatting and padding, the computer sticks during printout more than if one uses MID$ for the same purpose, and sticks even less often when one uses the TAB functions.

Lionel H. Doy

What you have noticed here is in fact caused by two different effects, neither of which is a bug. Your first query is about the disk stopping every so often when reading data and then printing it. Let us have a look at how the disk drive works. We can draw a simplified diagram of the disk drive like this:



The Disk Drive is the actual drive unit which you put your diskette into. The two Controllers contain a microprocessor each, which make your disk drive more intelligent than the PET! The Buffer is an area of RAM in the disk drive used to hold data from the disk drive until it is required by the PET. Data is read from the disk drive by the Drive Controller in blocks of 256 bytes and stored in the buffer, from where it is read by the Interface MPU and fed to the IEEE bus and so to the PET in response to your INPUT # or GET # statements.

When you have read all the data from the buffer, the Interface Controller sends a message to the Drive Controller asking it for some more data from the disk drive. If enough time elapses between these requests, the Drive Controller turns the drive motor off to save wear and tear on the disks. Now compared with the speed at which data is read off the disk (which for a typical double density disk drive is around 250 kbits/second) even a fairly fast printer is slow at say 180 characters per second, so the disk drive motor stops quite regularly to let the printer catch up.

The other effect is our old friend 'Garbage Collection', which arises whenever you are doing large amounts of string handling, and using large string arrays. As my learned friend Uncle Costan dealt with the matter admirably in October, I shall refer you to that for a full explanation.

The reason that your program works more quickly using MID$ than LEFT$ is that it happens that in this case MID$ generates less garbage. Another program might work more quickly the other way round. The TAB function does not produce any garbage at all so is much better! By the way, the new 4000 and 8000 series PETs uses a much more efficient method of garbage collection which is so fast it's almost undetectable. You can get the advantage of this by upgrading your PET by buying a BASIC 4 upgrade ROM kit, provided that all your existing software will run under BASIC 4. The software supplier should be able to tell you if it will.

Elephantine Memory

Dear Tommy,
I have an 8K PET which has been upgraded to 32K, and I am wondering if I can buy some extra memory to increase the PET's capacity to 64K. Is it possible to replace the existing memory chips with larger ones?

P. Truscott

I am afraid that the answer to both your questions is no. The problem with increasing the memory capacity beyond 32K is that the top half of the 6502 address space, from 32 to 64K, is largely taken up with screen memory, I/O chips and the BASIC and operating system ROMs. There are a few vacant slots (the exact number depends upon which PET you have and whether you have any add-on goodies like the Toolkit fitted), but these are intended for extra ROMs. To fit any extra memory you will need to know quite a lot about the hardware. You cannot replace the existing RAM chips with larger ones. If you have a 1K chip, for example, there will be 10 'address lines', which are used to select one of the 1024 memory 'cells' in the chip (1024 being 2 to the power of 10). A 2K chips will need an extra address line, as it has twice as many cells, and this will not be provided on your machine.

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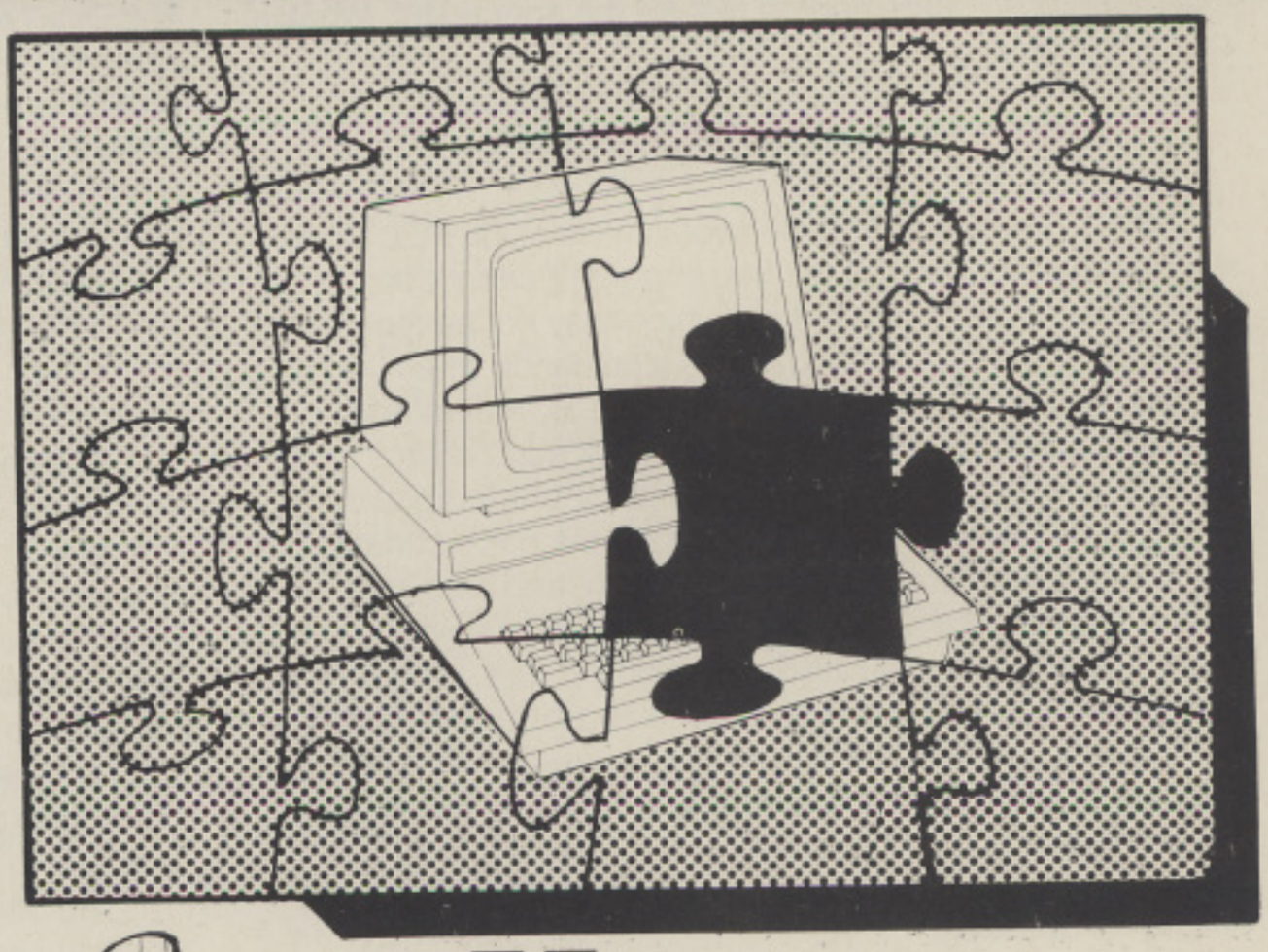

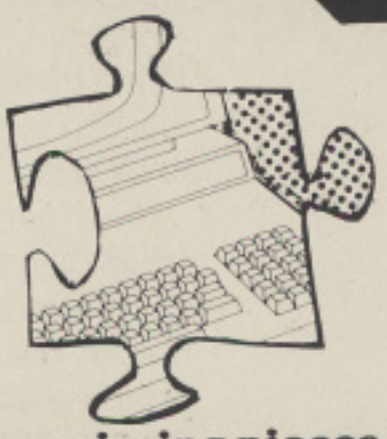

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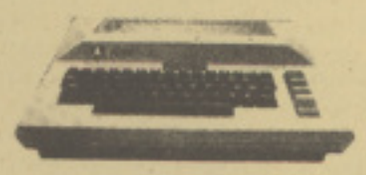

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620 ZZ=0:FORJ=0TOY:Z=0:FORJ1=1TOTE-4
300 F=R*.01:FORJ=0TOY:DF(J)=(1/(1+F))↑J:NEXT:
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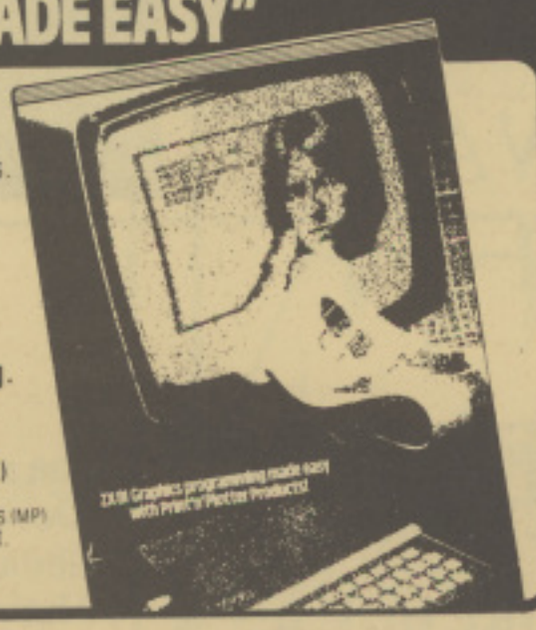

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34 ◀ DREAM & REALITY

his Atari just two years ago. Before then, he had no programming knowledge or experience whatsoever, 6 months later he sold his first program, and 12 months after that he'd done "My First Alphabet" which immediately won first prize in Atari's APX for that quarter, and then scooped the $25,000 pool.

The program is intended for young children and draws the most amazing pictures on-screen, accompanied by music. If the child hits the right key for the initial letter of the object in the picture there's a musical reward and another picture. The wrong key produces a gentle disharmony and an invitation to try again.

My test kids loved it!

I've tried it on lots of kits, some of them handicapped, and it's been a pleasure to watch them use it and a winner with them all. If you have a young family, get it and treasure it, for it's a five-star piece of programming.

Unhappily, it's only on disk (because of the random access required) but it only needs 24K so there should be no memory worries. The £22.50 price shouldn't bankrupt you either.

And that brings me neatly to the final word in this article. I hear from Atari that they're running a special promotion aimed at encouraging a higher number of disk drive owners. The plan is simple: buy an Atari 800 computer and get your choice of three free programs from the best of the APX catalogue, which can effectively knock some ten to twenty percent off the price.

An excuse to buy that drive

As this article appears, the promotion should be just about to start. This could therefore be the excuse you've been looking for to persuade the wife that you simply have to have that disk drive, rather than some of those boring old things for the house she keeps going on about.

Certainly now that Atari have arrived in this country, there are going to be a lot of programs available for their computer. A lot will be from Atari, and many more will be those which, in ever-increasing numbers, are being advertised in the American computer magazines (always a reliable barometer to a computer's increasing popularity).

I'll be having a lot more to say about those independent programs in subsequent articles, because I've seen many of them and for the most part they're really quite incredible. I'll try to make sure you get the best, for make no mistake about it, the giant's finally arrived himself; he's here to stay; and it's no overstatement to say things aren't going to be quite the same again.

◀ FINANCIAL MODELLING

The method used to swap information between these packages is quite neat, involving a method of forming all the files into a standard format called DIF for Data Interchange Format. This was developed by Software Arts, originator of VisiCalc, just to anticipate future products and make sure that they could interface with VisiCalc.

So VisiCorp is moving upmarket in modular fashion, while other products like Micro-Modeller are starting right at the top. And the future? Micro packages handling bigger and bigger models at greater and greater speeds with more and more analysing features, squeezing the mainframe packages and bureaux services into a small corner of the very top end of the business. Comshare's Pendse says he is not afraid of the micro versions of his company's giant modelling techniques. "It's all increasing the public's awareness of financial modelling, and it's good for all of us in the business," he says. Sound familiar? It's just what the micro makers are saying about IBM's dramatic entry into the personal computer lists. We'll see, we'll see...

69 ◀ SINCLAIR SPECTRUM

played on the internal speaker. OVER is a method by which text and graphics can be overprinted – making possible vowels with accents, for example. The Spectrum has also been shown with a 40 x 25 Teletext compatible display entirely done in software. A good deal of programming would seem to be involved as characters are reduced to 6 pixels in width, and the subject is *not* documented. It does, however, open up some interesting possibilities for the future.

Documentation

The instructions are of a very high standard – there being two manuals. The 30 page introduction is for the complete beginner, and goes through very simple programming to straightforward colour and sound. The 220 page manual is a complete course in BASIC. It deals comprehensively with the most sophisticated features, and includes a considerable amount of technical information about memory maps and similar esoterica.

Software was pretty well non-existant at the time of the launch, though Sinclair did make a concurrent announcement of their intention to move into software publishing for both models – starting with quite an impressive range for the '81. No doubt as with that machine, though, a large number of small independent companies will soon be tumbling over themselves in a race to develop the first Invaders, Chess, Household Budget planner program (does *anyone* plan their household budget on a computer?) etc.

All of which may leave you with the impression that the Spectrum is so powerful that there is hardly room for competition. Not so.

One weakness is still the keyboard. Though the Spectrum may well end up on the desktops of several small traders, it cannot really be expanded to full business status in the same way as, say, the Commodore VIC 20 can.

Secondly, though the graphics *are* excellent, they don't match up to the Player/Missile graphics of Atari – or "Sprite" graphics on Commodore's newly-announced low-cost VIC-10. With no facility for plug-in ROM packs, the Spectrum is rather less than the bee's knees as far as arcade games go.

Finally, and paradoxically, the machine's very low cost could even turn out to be a minor disadvantage in terms of encouraging independent suppliers to develop quality peripherals and software for it. Well, who is going to offer a 5 megabyte hard disk for a computer costing £125?

No, cancel that last comment. Someone's bound to. And it could well be Sinclair himself. After all, it is only a few months since Inside Trader joked about a Sinclair Microdrive costing £25.

He was only £25 out.

ENHANCING PET BASIC 79 ◀

from the assembler listing. Aim to hit that '20' in $300E.

When you are ready to use it, use 'SYSxxxxx' instead of 'KEYINP', where 'xxxxx' is the decimal address of that fifteenth byte.

If you have any problems with it, or if you want to swap any ideas, we will be glad to help if we can. Try Durham 711380, and we may be able to let you have Hex dumps to save you typing it in, or an EPROM if you want to go fully to the extra BASIC routines.

Next month, we will have a Sort routine for you, which works equally (and quickly) on both strings and on numbers.

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INSIDE TRADER

Fellow connoisseurs of Fleet Street hyperbole will join me in congratulating *Personal Computer World* Editor Petit Pierre Rodwell on his well advertised "World Exclusive" on the Sinclair Spectrum, which appeared somewhat *after* reports in other journals (this one included). Nonetheless I think their great IBM "scoop" still wins by a nose; that one appeared a full month after ours.

Inflation appears to have struck Silicon Valley in a most improbably spot: the chip numbering departments. The original 8-bit microprocessors rejoiced in designations like 6502 and 8080. With the introduction of 16-bit C.P.U.s, Zilog and Motorola raised the ante to Z8000 and 68000 respectively. Now lest anyone miss the point, the ever-modest Jack Tramiel has ordered that Commodore's new (supposedly secret) 32-bit microchip be designated the 650,000.

'A' for effort to Ealing dealer Dave Whitehead of Adda Computers, for his latest sales idea – computer parties. If Tupperware can sell at parties, why not us, he reasoned. Alas Whitehead's first two soirees suffered disruption from a number of disappointed leather and latex enthusiasts apparently under the impression that computer dating, or possibly, mating, were somehow involved.

Riot and romance, mishap and mystery reigned at our Mid-Summer Ball. Why, for example, did Microsoft Manager and part-time policeman, Matthew Wauchope, get his face slapped in mid-smooch by the lovely Karen Chambers? The absent minded amorist himself remained in ignorance of his transgression until he discovered his truncheon in his pocket.

Congratulations to Burroughs on a neat solution to an awkward problem. To wit, what to do about a personal computer set to retail at the embarrassingly high price of £4000. The answer, and I quote, is that "the B20 is not a personal computer. It is a multi-function business oriented workstation." Like the IBM, er, Personal Computer?

I see that micro manufacturers have now taken to reporting each other to the Advertising Standards Authority. Companies recently to have featured in complaints to this toothless old watchdog include Sinclair and Commodore. Both are said to nurse a shrewd suspicion as to which of their peers was party to their embarrassment. A rash of unwarranted complaints are now expected against Another Purveyor of Personal computers and Like Equipment.

An entertainingly acrimonious row is brewing between *Byte* columnist Sol Libes, doyen of computer freaks, and Silicon Valley gadfly, Hal Hardenbergh of Digital Acoustics Inc. The trouble started when Hardenbergh congratulated Libes on his news report that Chuck Peddle was working on the Sirius 1. The story, even after subtraction of *Byte's* famed four months lead time was then some ten months old. Libes is believed to be sending Hardenbergh a complete set of the ninety odd back issues of Byte, each of which weighs two pounds. Delivery will be by air – from a helicopter hovering 2000 feet above Hardenbergh's office.

I share Intertec's deep sense of outrage at Julian Allason's impertinent, and no doubt libellous, suggestion that their SuperBrain *might be less than 100% reliable. I am therefore suppressing the press release which announces the opening of a vast new maintenance centre near Slough. A spokesman is quoted as being of the opinion that SuperBrain repairs should be worth a cool £100,000 a year.*

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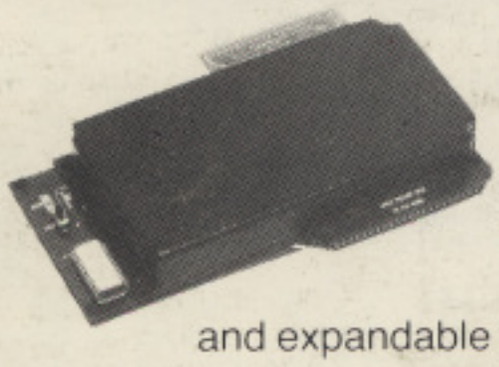

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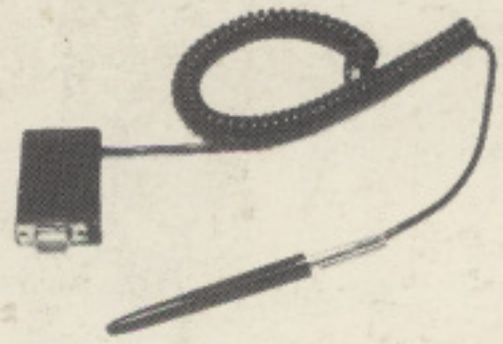

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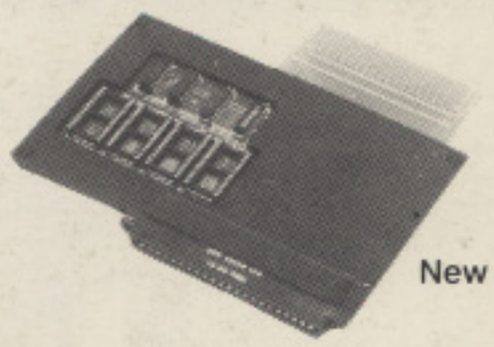

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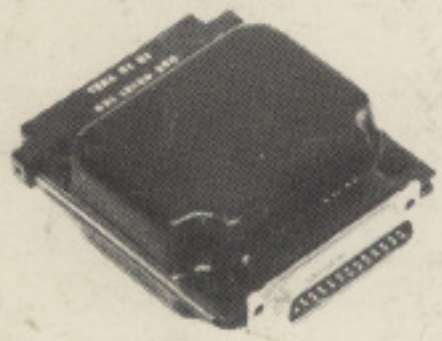

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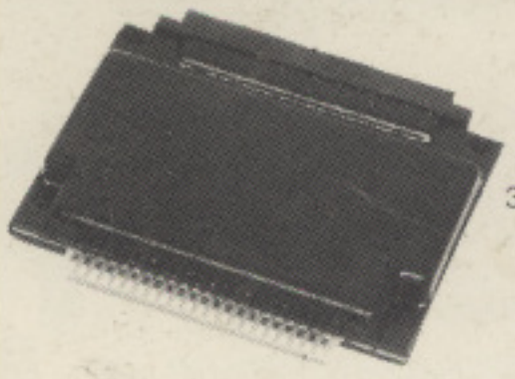

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